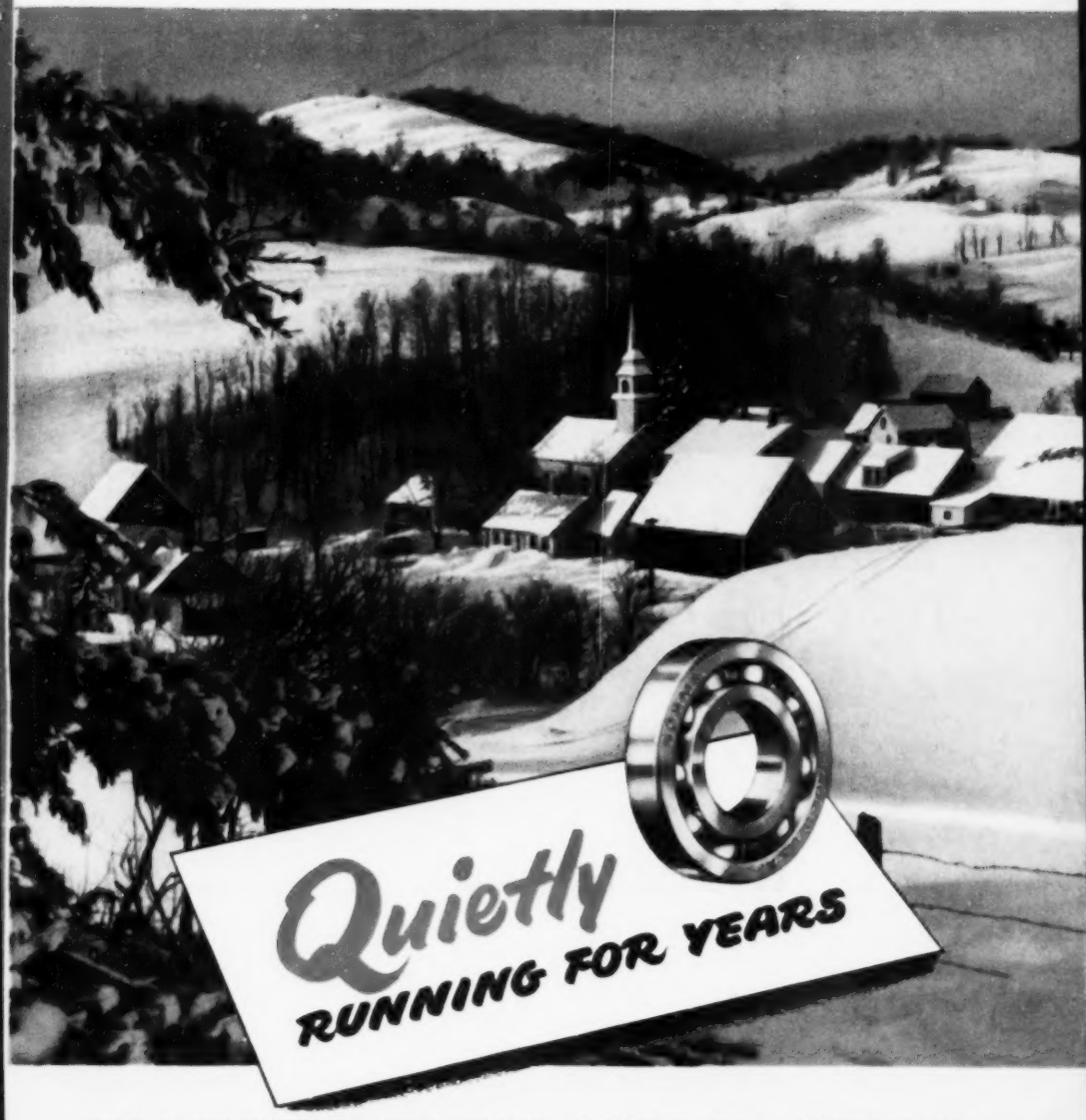
MODERN Machine Shop

January, 1951

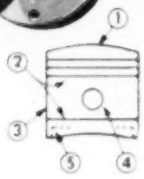


NORMA-HOFFMANN BEARINGS CORP'N, STAMFORD, CONN., FOUNDED 1911

precision horsepower ...by Heald

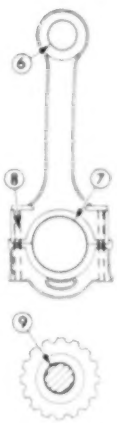
No—Heald doesn't make these piston and crankshaft assemblies. But Heald machines do! In fact the speed and precision of Heald grinders and Bore-Matics have long been important factors in the mass production of automotive parts. The nine Heald operations performed on the assembly shown above are typical examples.

Remember—when it comes to precision finishing, it pays to come to Heald.



Piston, conn rod and crankshaft components. Precision finished on Heald Bore-Matics

1. Piston dome centered.
2. Piston O.D. grooved for piston rings.
3. Piston O.D. turned, straight or elliptical.
4. Piston wrist pin holes bored and grooved.
5. Piston skirt inside diameter bored.
6. Wrist pin holes in conn rods bored, steel and/or bronze.
7. Crankshaft holes in conn rods bored.
8. Conn rod bolt holes bored.
9. I.D. of crankshaft end bored.



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VOLUME 23 NUMBER 8
JANUARY, 1951

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Published monthly and copyrighted (1950) by
GARDNER PUBLICATIONS, INC.
431 Main St., Cincinnati 2, Ohio

Printed in U. S. A.

Acceptance under Section 34.64, P. L. & R., Authorized

MODERN Machine Shop

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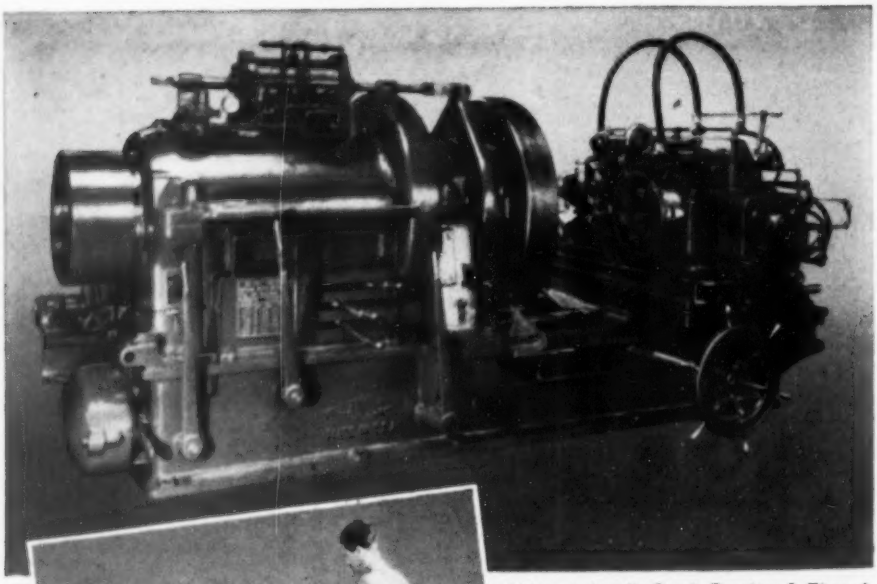

(Above) Landis Bomb Turning & Threading Machine: Arranged for turning, facing, chamfering, and threading tail end of bomb at one chucking. **(Left) Landmaco Shell Topper:** Type R Shell Topper topping the nose end of 75 mm. shells.

Landis Threads Again Help America Rearm

Threads produced by the various types of Landis Threading Equipment are again important in the operation of war matériel. Hundreds of Threading Machines, thousands of Die Heads and Taps, hundreds of thousands of sets of Landis Chasers were supplied to manufacturers of war matériel during World War II. It was once estimated that enough Landis Taps were in use to thread 20,000,000 shells a month.

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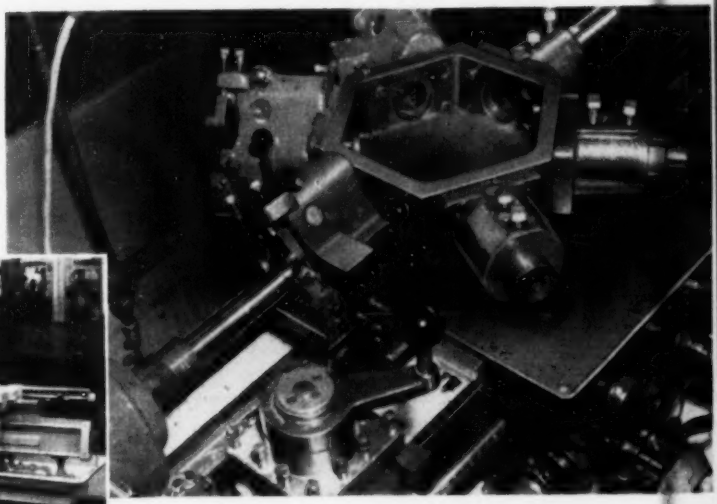

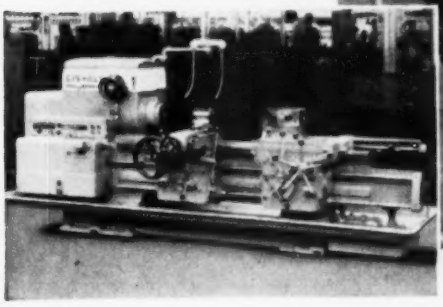

no extra equipment needed!

With no more than your standard bar equipment, you're all set to cut machining costs on shafts like these. No previous operations . . . such as cutting to length or centering . . . are necessary. And with *two or more tools* from turret and side carriage, you have the basic advantage of turret lathe economy—the time saving that means lower costs.

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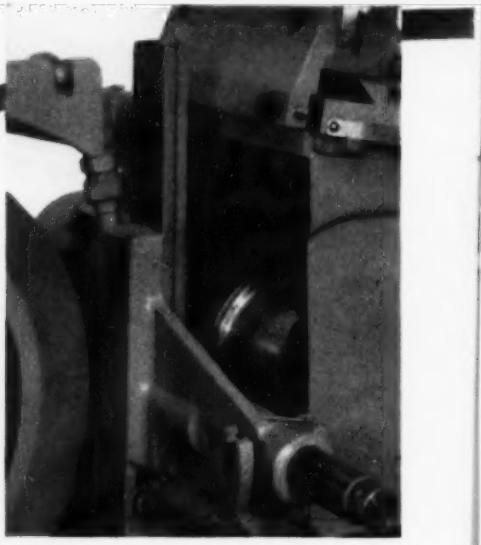
RANGE

Pin Point to Bowling Balls

. . . Centerless Ground at Lower Cost on New Cincinnati FILMATIC



Some sizes of CINCINNATI FILMATIC Centerless Grinders are engaged in grinding hypodermic needles to almost a pin point in diameter. Others are engaged in grinding tap blanks, still others in grinding bowling balls to the close roundness and accuracy required for a clean strike. Whatever their "occupation" you can be sure that they are producing high-quality work at a rapid rate and low unit cost. Considering the popular No. 2 size, for example, here are some of the reasons why:

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b) Automatic lubrication, including the slideways; greatly extend the service life of the machine.

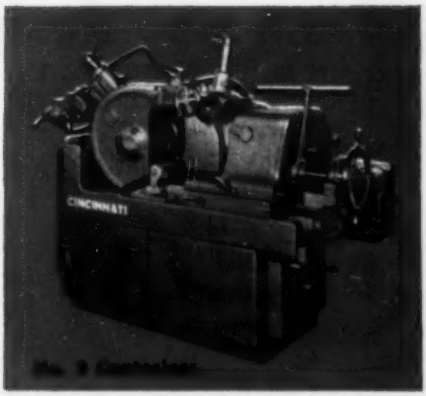
c) Swivel adjustment of regulating wheel slide; reduces set-up time.

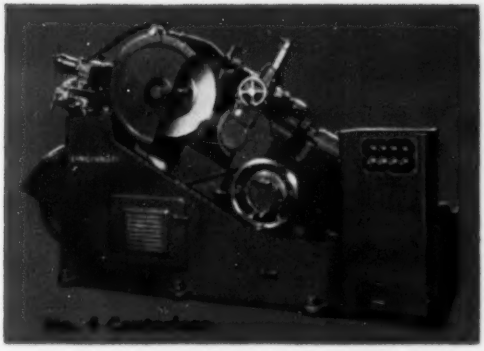
d) Wide variety of attachments and fixtures; for every centerless grinding operation, including some you might not suspect of centerless application.

Other advantages of CINCINNATI FILMATIC Centerless Grinders are outlined in literature. Write for copies. Then ask for a visit from our Field Engineers, who are ready to help you with your precision grinding problems.

CINCINNATI GRINDERS INCORPORATED, Cincinnati 9, Ohio

Entire length of tap blanks, including points, are ground at a production rate of 300 per hour, removing about .010" from all diameters. Machine—CINCINNATI FILMATIC No. 2 Centerless Grinder, equipped with magazine loading device.





Bowling balls are ground to accurate roundness and size on a CINCINNATI FILMATIC No. 4 Centerless Grinder equipped with automatic loading fixture. Production 22 per hour, removing about .025" stock.

CINCINNATI FILMATIC Centerless Grinding Machines, and corresponding literature. Brief specifications in Sweet's.

No. 0: Publication No. G-576-1
No. 2: Publication No. G-591
No. 3: Publication No. G-570-1
No. 4: Publication No. G-538-1
No. 5: Data on request
No. 6: Data on request

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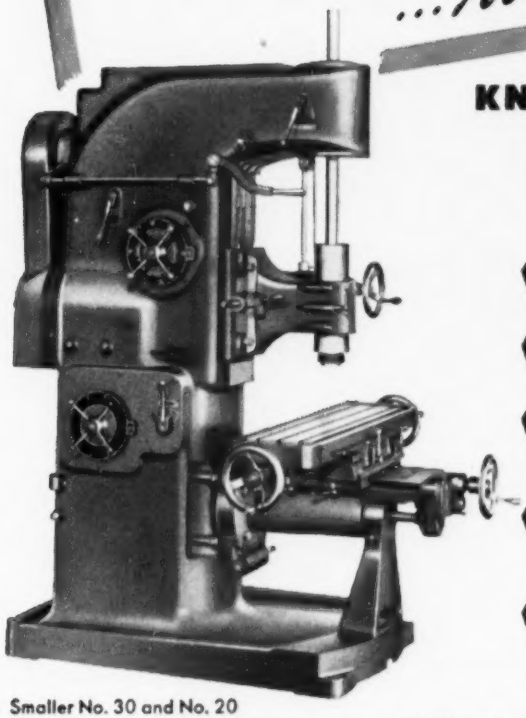

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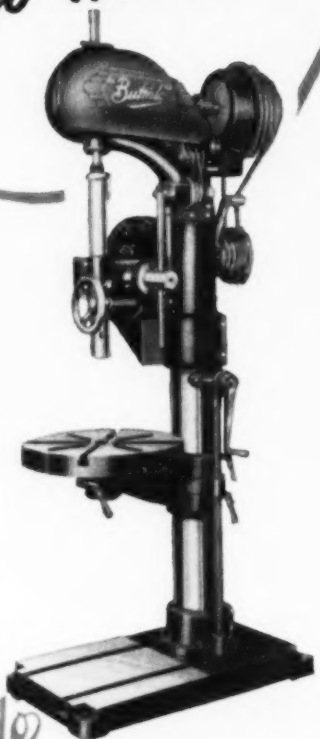

Here's a powerful back-geared 8-speed drilling machine for general machine shop and production work. The No. 21 Drill has direct or back-geared drive and both lever and hand wheel feeds; countershaft is mounted on ball bearing pillow blocks for smooth and trouble-free operations. Crank adjustments for setups save time, as does the convenient location of all controls. Drilling capacity is 1½" in cast iron. 27" space from spindle nose to table allows room for most of your jobs. WRITE FOR BULLETIN 3746. Here's a drill with the features you want for all-around job work. **There's A Drill For Your Operation** in the complete "Buffalo" line—from the high-precision No. 14 (⅜" capacity) Drill on up to the giant No. 22 (2" capacity)—one to six spindles, bench or pedestal models. WRITE US ABOUT YOUR NEED!

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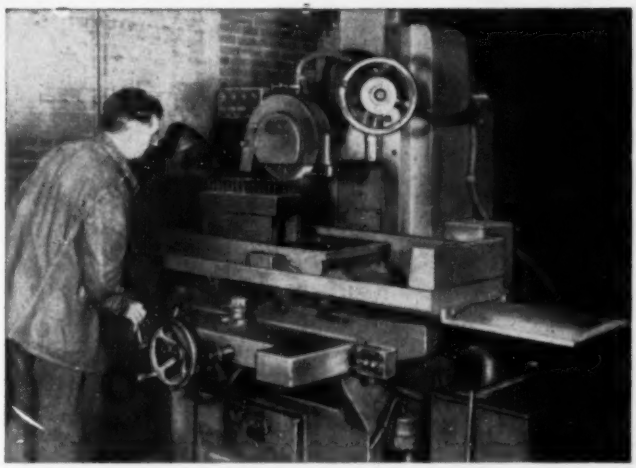

True Temper Corporation, manufacturers of True Temper Products, use fourteen Grand Rapids Hydraulic Feed Surface Grinders in ten of their factories. The machine shown is a 55A.

You will appreciate the micro-inch finish produced at production speeds on Grand Rapids Grinders. All Grand Rapids Hydraulic Feed Surface Grinders have these outstanding features:

1. **One-piece column and base casting for vibrationless rigidity**
2. **Precision ball-bearing spindle which is greased for life**
3. **Bijur one-shot lubrication system eliminating hand oiling**
4. **Patented vertical movement of wheel head for quick, accurate adjustments**
5. **Portable coolant tank for ease of coolant replacement**
6. **Vane type hydraulic pump for fast longitudinal table travel**

to serve you—

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RIGIDITY
that Assures Accuracy

FOSDICK
Upright
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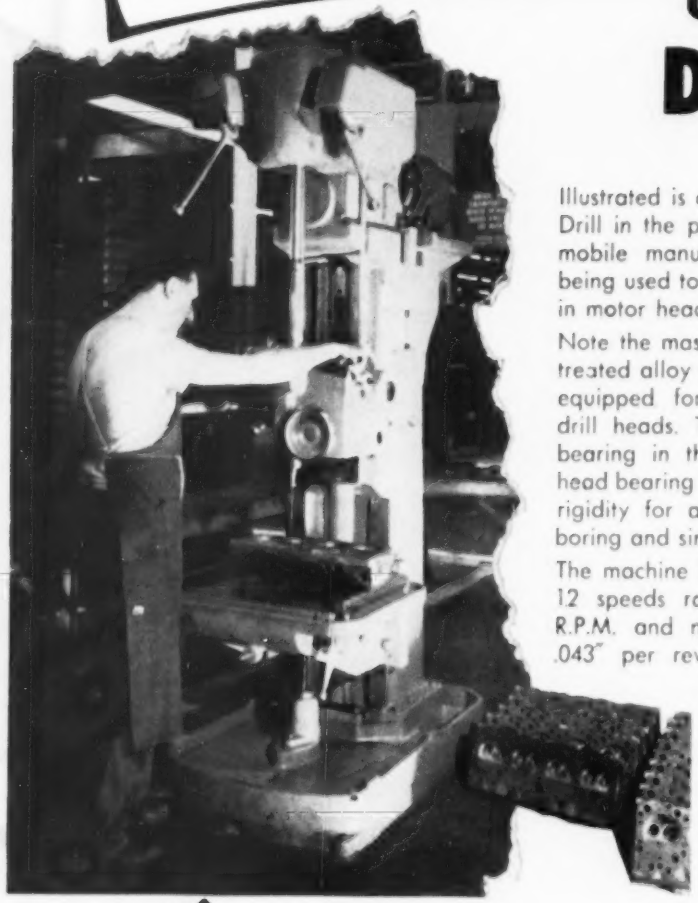

Illustrated is a new Fosdick 25" Upright Drill in the plant of a prominent automobile manufacturer. The machine is being used to drill numerous small holes in motor heads.

Note the massive spindle made of heat treated alloy steel. The spindle sleeve is equipped for attachment of multiple drill heads. The spindle sleeve has a bearing in the sliding head equal to head bearing on the column. This assures rigidity for accurate drilling, reaming, boring and similar operations.

The machine is normally furnished with 12 speeds ranging from 60 to 1500 R.P.M. and nine feeds from .005" to .043" per revolution of spindle. Both feeds and speeds are controlled by single direct reading levers.

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CINCINNATI 23, OHIO

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Let's get the facts STRAIGHT

about oil fog...oil mist...oil spray lubrication

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Pride in our past achievements leads us to present the following facts, so that more of industry interested in better lubrication will get the facts *straight*.

Norgren pioneered in the development of the *oil fog principle* of lubrication *more than twenty years ago*. Being first in the field, Norgren naturally had to perform all of the fundamental research and basic experimentation which was necessary. The subsequent years of development have given Norgren an immense amount of enviable knowledge and experience about *oil fog lubrication*.

On high speed spindle lubrication, Norgren also took the lead. *Fourteen years ago*, we introduced the first Norgren oil fog lubricator into this highly specialized field—and many contributing developments followed. At that time, spindle speeds of 15,000 r.p.m. were considered high. But with this Norgren aerosol lubricator sensational results in longer bearing life were produced. Thus, the Norgren spindle lubricator was directly and solely responsible for the development of present high spindle speeds of 100,000 r.p.m. and more. This Norgren *oil fog principle* is the most widely accepted method of high speed spindle lubrication today.

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Norgren

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abrasive discs

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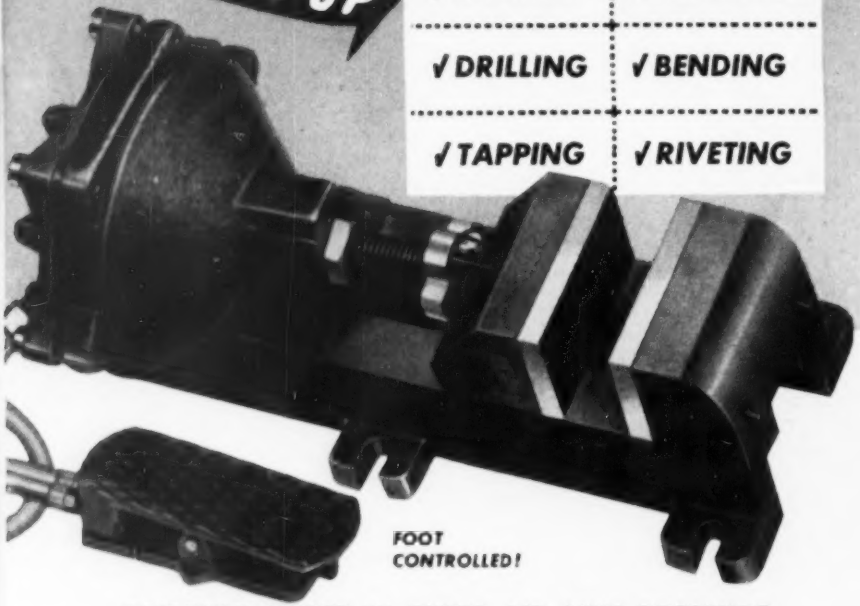

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Model WD-10 Wet or Dry 10" Carbide Tool Grinder.

Hammond Machinery Builders INC.

1615 DOUGLAS AVENUE **KALAMAZOO, MICHIGAN**

MORSE
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MORSE
Want Sure-Shot Production?..

Then Remember—

MORSE QUALITY

. . . in every type of cutting tool . . . is sold only by your

MORSE-FRANCHISED DISTRIBUTOR

MORSE MEANS *MORE* PRODUCTION . . . smoother, more accurate production . . . with every type of cutting tool from drills, reamers, taps and dies, to end mills, milling cutters, slitting saws and "specials."

And Morse Quality is steadily being advanced by Morse Engineering and Research . . . as you would expect of the company that originated and developed the twist drill.

That's why, on every cutting tool order, it's good business to specify "MORSE" and shoot it in to your Morse-Franchised Distributor. And if you want still *higher* production, specify "MORSE Electrolized."

Morse Twist Drill and Machine Co., New Bedford, Mass. (Div. of Van Norman Co.)
Branch Warehouses in New York, Detroit, Chicago, San Francisco

MORSE

"MARVEL" HAS always had the edge

MARVEL High-Speed-Edge Blades assure Faster, more Accurate cutting with proven Economy and complete Safety. Only the MARVEL is a composite blade with a high speed steel cutting edge electrically welded to an exceptionally tough, strong alloy steel body.

The High-Speed-Edge does the cutting while the alloy back with hardened eyes, carries the load. Blade tensions up to 300% higher than those possible with ordinary blades are recommended. This greater tension is confined to the cutting or leading edge by the location of pin holes (exclusive MARVEL design feature) and cannot be overcome by work resistance. Heavier feeds and greater speeds are practical without "run out."

With greater accuracy, higher production and lower cost per cut, come the extra dividend of Safety, for MARVEL High-Speed-Edge Hack Saw Blades are Positively Unbreakable—*they will not shatter.*

Ask your local MARVEL distributor (see classified phone book) to help you modernize your metal sawing with MARVEL High-Speed-Edge Blades. They cost no more than ordinary high speed steel blades.

1. High Speed Steel cutting edge.

2. Tough unbreakable alloy steel body with hardened eyes.

1. & 2. Integrally welded to make a fast-cutting, long lasting composite blade that is positively unbreakable.

ARMSTRONG-BLUM MFG. COMPANY

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE CHICAGO 39, ILLINOIS

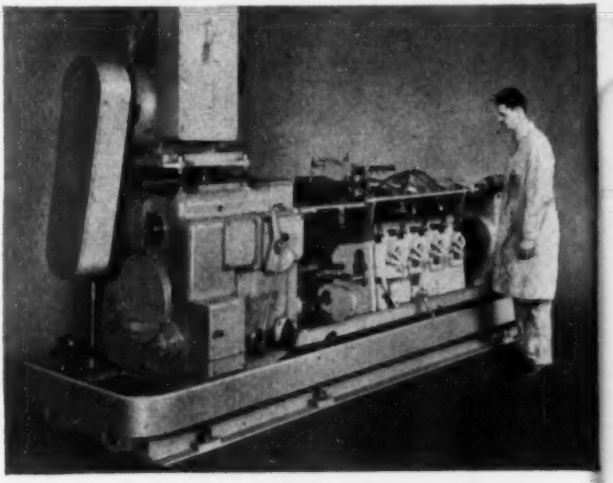
Metal Cutting MARVEL SAWS

Better Machines—Better Blades

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

MODEL "AP" Lo-swing LATHE MACHINES ELECTRIC MOTOR SHAFTS



Problem: To rough turn, face shoulders and groove electric motor shafts machined in small and medium size quantities.

Solution: This new Lo-swing Semi-Automatic Lathe, featuring *unlimited length of carriage travel thru rack and balanced twin pinion carriage feed*, is ideal for machining short and medium run jobs economically. Unlimited carriage travel permits turning of short run jobs having long shoulder lengths with simplified tooling; multiple tooling may be used for long run jobs with short or long shoulder lengths.

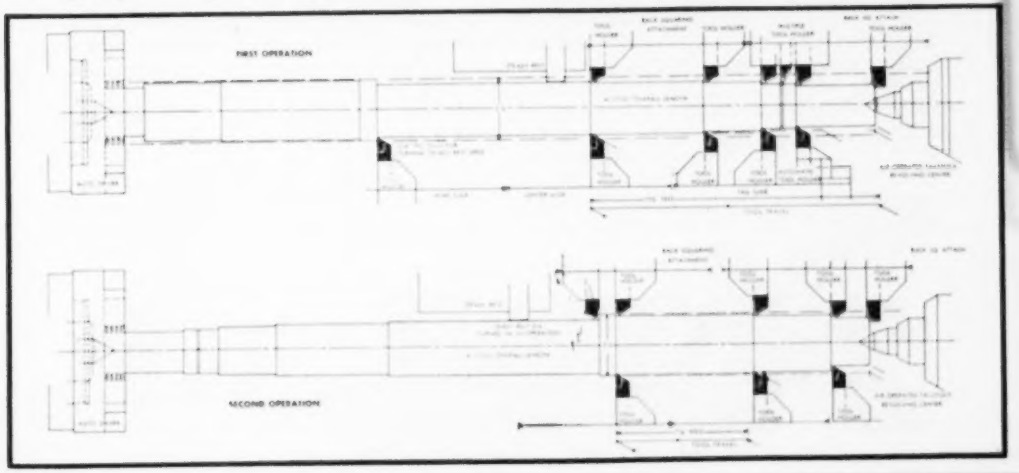
The drawings below show a typical two operation tool setup on electric motor shafts which are being machined in small lots. Only the one tool is being used for turning each diameter regardless of the length of cut.

Machine setup is simplicity itself. First, the tool blocks and tools are mounted on the tool slides in the proper relation to each other and for the proper depth of cut. Secondly, two stops are set for controlling length of carriage travel in both directions and one stop for positioning the carriage in relation to the work piece. The lathe is then ready for production.

Tool relief is automatic on the return stroke of the carriage and rapid traverse movements to and from the work are available by throwing a lever.

Investigate the many unique features of this new semi-automatic lathe.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.



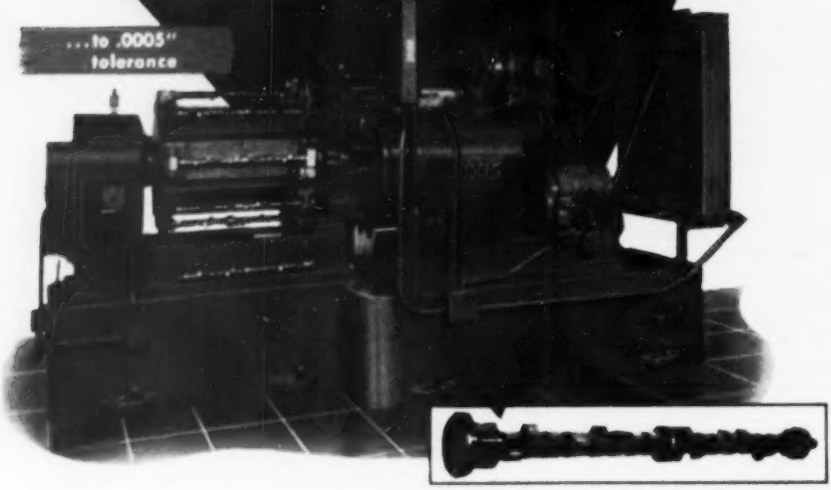
PRODUCTION COSTS ARE LOWER WITH Lo-swing

Accuracy plus Speed

MORRIS *Mor-Speed* MACHINE performs 16 machining steps on camshaft flanges.

...Production rated: 200 pieces per hour

...to .0005" tolerance



There's no secret in the amazingly high production records set by MORRIS *Mor-Speed* Machines. Each one produces faster, with micrometer accuracy, more parts at lower cost . . . because it's designed for the specific job. Yet their cost is low, compared to ordinary "special purpose" machines, because each comprises many standard parts, engineered to do the special job. Four holes on the flange of each of eight precision camshafts are drilled, reamed, counterbored and tapped on this MORRIS 8 Station Indexing Machine. Work pieces are indexed to the hydraulically operated head by means of a Geneva cam mechanism. The lead screw feed tapping head is driven independently by a reversing motor. Eight hand clamp fixtures hold the work pieces. Production is rated at 200 pieces per hour at 80% efficiency.

MORRIS High Production Machines save space, time and costs for leading manufacturers the nation over. If you have multiple drilling, reaming, tapping and boring operations on a mass production basis, ask Morris Engineers for a no-obligation estimate of savings possible on your specfic jobs.

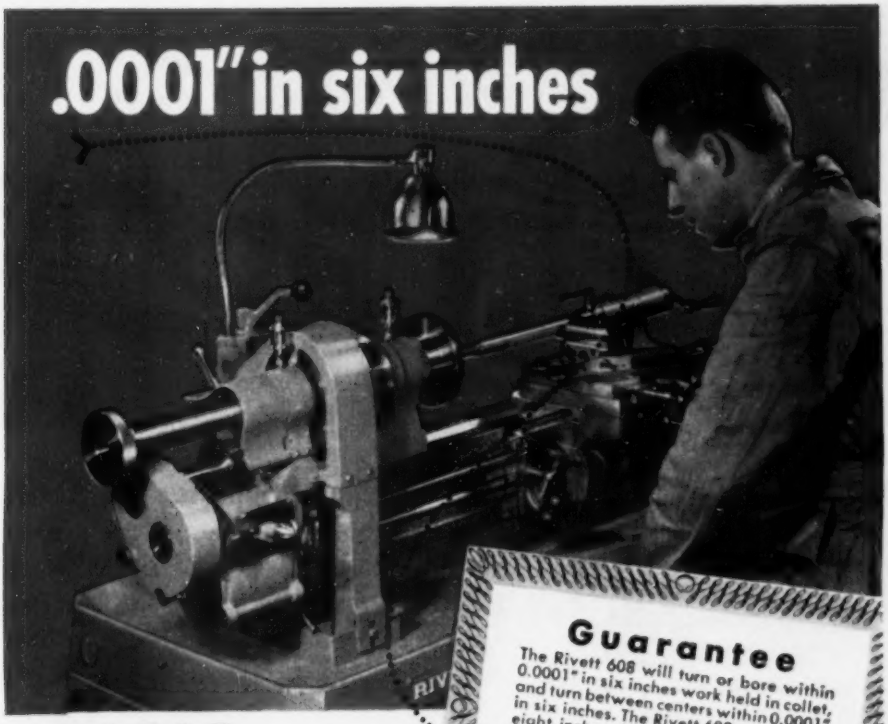
THE MORRIS MACHINE TOOL COMPANY

"A better product at less cost— with MORRIS ENGINEERED PRODUCTION"

MOR-SPEED

934 HARRIET STREET CINCINNATI 3, OHIO

.0001" in six inches



Guarantee

The Rivett 608 will turn or bore within 0.0001" in six inches work held in collet, and turn between centers within 0.0001" in six inches. The Rivett 608 will face to eight inches diameter within a limit of 0.0002" concave, 0.0000" convex. The Rivett 608 will cut threads within 0.0005" in twelve inches, or within 0.0003" in any three inches, or within 0.0002" in any inch of a specimen piece.

PLUS every known attachment

A symbol of extreme accuracy, this Rivett 608 lathe is used in nearly every instrument and tool shop where fine exacting work is performed. A greater number of mechanical marvels have been developed on this lathe than on all other machine tools combined. The 608 is a small but exceedingly powerful back-geared, screw cutting engine lathe, with slide areas equal to those of other lathes twice its size. Finely-made attachments are available for milling, spiral-cutting, slotting, relieving, taper turning, radius turning, grinding, and forming. **Write for Bulletin 608F.**

RIVETT LATHE & GRINDER, Inc.

Dept. MMSI Brighton 35, Boston, Mass.

For More Precision Work RELY ON RIVETT LATHES AND GRINDERS, The Master Craftsman's Master Tools

UNITITE — 3-Way or 4-Way Valves . . . quick-acting, packless . . . for pressures to 250 psi, in three mounting styles.

It Pays to Use . . .

HANNA® *Operating* VALVES

DEPENDABLE AIR and HYDRAULIC CONTROLS

¼" UNITITE—For light piping and tubing . . . control air, oil or water pressures up to 500 psi.

FOOT OPERATED—Either single or double pedal . . . for pressures to 250 psi . . . provides quick, effortless control.

SOLENOID—New 4-Way Valve . . . small, compact, low current consumption . . . adaptable to straight line piping.

"MASTAIR" — Balanced spool type . . . controlled by one 4-Way or two 3-Way pilot valves . . . pipe connected to bottom or sides.

PILOT VALVES — 3-Way . . . for direct control of small cylinders, automatic control of large cylinders as pilot for "Mastair."

"FLO-SET" — For precision speed control of low pressure cylinders . . . micrometer graduations . . . for air, oil or water control.

FIFTY YEARS of designing and manufacturing quality products lie behind the *precision* construction and *dependable* performance of Hanna Valves. A recent test with a Hanna Unitite Valve showed, for example, that it was still going strong after *10 million cycles of operation* and should be good for another 10 million, representing about 20 years of reliable, maintenance-free service!

The valves shown here are but a few of the complete line of Hanna operating valves for dependable control. So wherever or whenever you have a control problem, look to Hanna for the practical solution. There is a Hanna Valve "just right" for your requirements.

Send for Catalog

New Valve Catalog No. 254 gives features and specifications on all Hanna Valves. Ask for your copy.

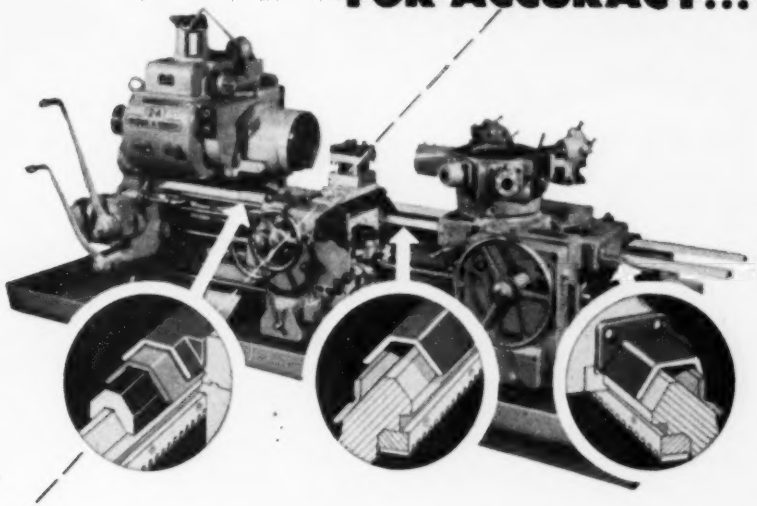
50th Anniversary 1901-1951

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1765 Elston Avenue, Chicago 22, Illinois

FOR ACCURACY...



•There is no substitute for VEE-WAYS

NEW MACHINE ACCURACY is maintained for many extra years of service because of a basic design which is a distinctive feature of all Warner & Swasey Saddle Type Turret Lathes. VEE-WAYS of high test nickel iron are cast integral with the DIAGONAL RIBBED, one piece bed. Induction hardened by an exclusive process for greatest wear resistance, the VEE-WAYS are then ground to smoothness and precision. The most heavily loaded saddle slides over the ways with an ease which makes hand wheel control almost effortless for the operator.

The VEE-shape distributes weight and pressure of saddle and loaded turret to make carriage self-aligning.

The heaviest roughing cuts and the finest finishing cuts are taken without necessity of adjustment . . . without possibility of weaving.

Patented Telescoping Way Covers (see illustration above) completely protect the VEE bed from scratches from chips or damage from dropped tools, etc.

Equally important, the Way Covers prevent the floods of coolant from washing away the film of lubricant carried to the Ways by automatic lubrication.

VEE-WAYS are only one of many valuable features of Warner & Swasey construction, but they are a fundamental principle which makes Warner & Swasey so easy to operate, and so outstandingly efficient in preserving extreme precision under long years of hardest service.

Your Warner & Swasey Field Representative can explain *all* the features of Warner & Swasey Machine Tools which make them so advantageous for low-cost production.

WARNER & SWASEY SELLS ONE THING
. . . INCREASED PRODUCTION

WARNER & SWASEY
Machine Tools
Cleveland

TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

PLACE YOUR ORDER **NOW** FOR

PRESS-RITE

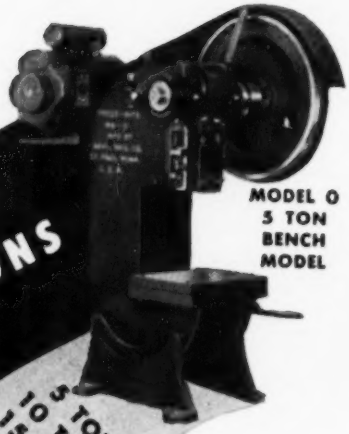
OPEN BACK-INCLINABLE

POWER PRESSES

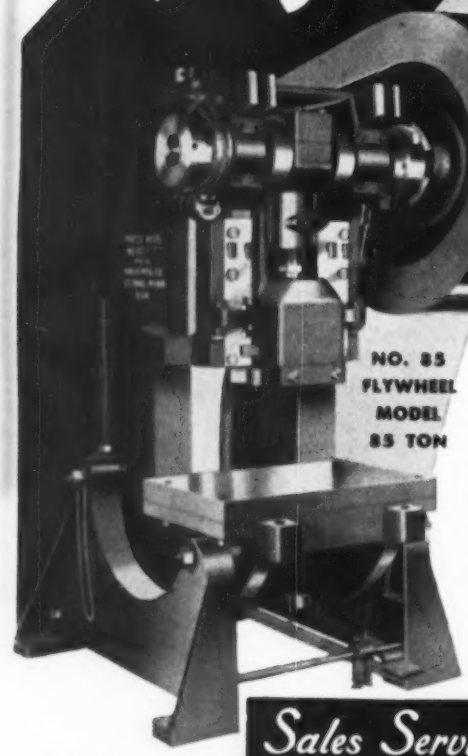
A COMPLETE PRESS LINE

5 TO 85 TONS

5 TON
10 TON
15 TON
20 TON
30 TON
85 TON



MODEL O
5 TON
BENCH
MODEL



NO. 85
FLYWHEEL
MODEL
85 TON

FOR
BLANKING
PUNCHING
DRAWING
FORMING
STAMPING

PRESS-RITE POWER PRESSES are now available in all models with reasonably prompt deliveries. Future material shortages may affect delivery schedules. Order now and have **PRESS-RITE PRESSES** in your plant for top production and lower operating costs. Take advantage of such **PRESS-RITE** features as Non-Repeat Single Stroke Safety Mechanism, Automatic Cam Actuated Brake, Greater Shut Height, and Triple Ramway Lubrication.

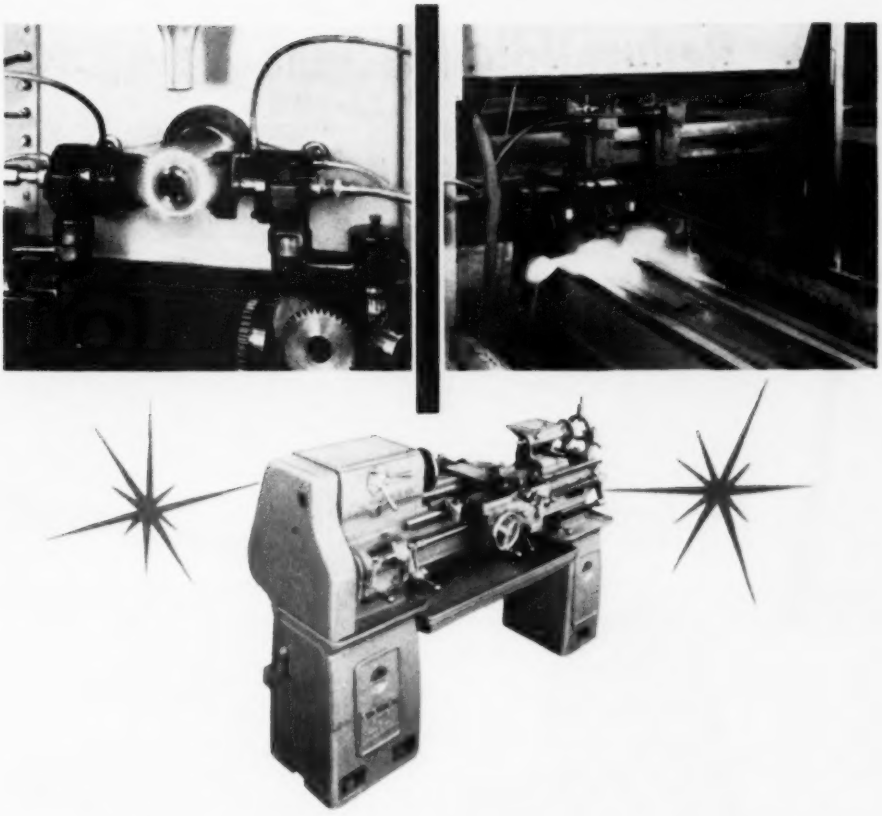
***WRITE TODAY** for free bulletin! You'll find that no press can match the **PRESS-RITE'S** many features.*

ALSO AVAILABLE IN
BACK GEARED MODELS

Sales Service Machine Tool Co.

2357 UNIVERSITY AVENUE
ST. PAUL 4, MINNESOTA

flame facts



Flame hardened gears throughout are standard . . . **flame hardened bed ways** are available at small extra cost . . . in Tray-Top light duty all geared head engine and toolroom lathes. Add these plus values to **versatility**: 12 spindle speeds, 48 thread and feed changes, top speeds to 1800 rpm., quickest changeover from English to metric thread chasing . . . **operator convenience**: centralized controls, instant speed selection with direct reading color-match speed selector, dual control levers, "Tray-Tops" on headstock and tailstock for parking tools, mikes, gages, etc . . . **operator safety**: totally enclosed change gear box, totally enclosed electrical panel, accessible only by opening master disconnect switch, feed levers disengaged in down position . . . **floor space savings**: cabinet legs really have room for chucks, face plates, etc., reduce or eliminate need for separate bench or storage space . . . Add up all Tray-Top's outstanding values and you'll find it your best buy. Swing sizes: 10", 12½", 15", 18". Write for new bulletin.

cincinnati lathe & tool co. CINCINNATI 9, OHIO, U.S.A.

VAN NORMAN

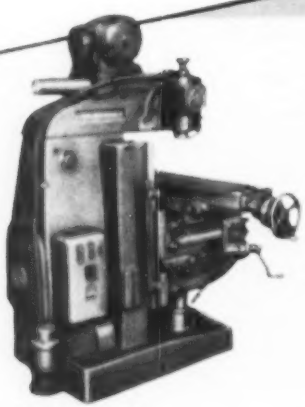
Reduce Idle Machine Time...

There's A Size To Meet Your Exact Requirements

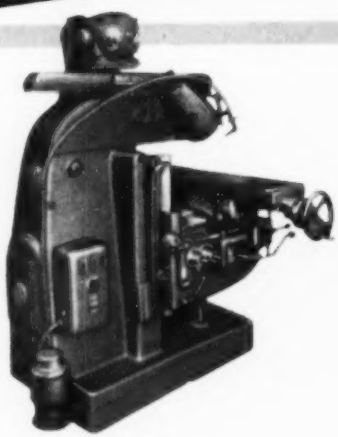
Manufacturers in all types of industries step up milling production, minimize errors and cut costs per man and machine-hour with Van Norman Ram Type Millers. These versatile millers enable you to perform any and every milling job from horizontal to vertical . . . simply by positioning the adjustable cutterhead. This means *one* machine gives you the work range of several types of single purpose millers.

In addition, Van Norman Ram Type Millers save time because most jobs can be carried through to completion without changing the work set-up.

See for yourself how these machines cut costs, improve accuracy and increase production in the tool room, machine shop, laboratory and pattern shop. Their adaptability makes them ideal for maintenance and repair work. They are available in a wide range of sizes . . . for every milling requirement. Write for information.



Model No. 22L
Table size: 45" x 10"

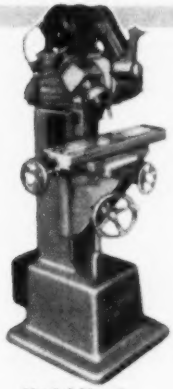


Model No. 26
Table size: 58" x 13"

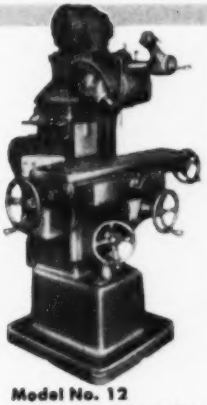
VAN NORMAN COMPANY

Ram Type Millers

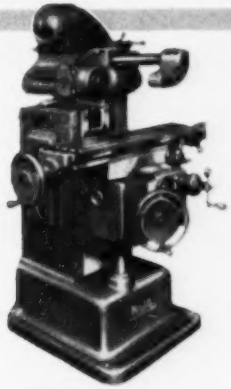
Cut Costs on All Types of Milling



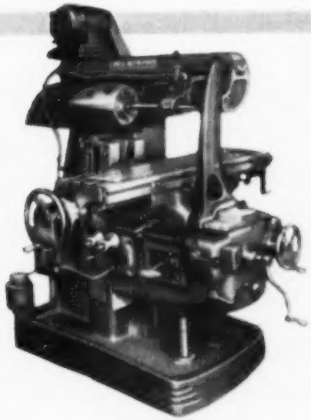
Model No. 6
Table size: 30" x 6⅞"



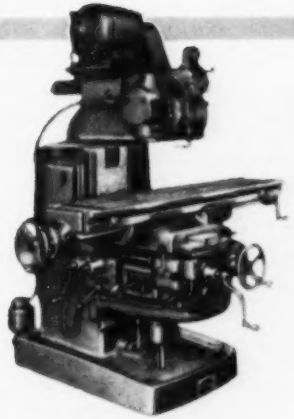
Model No. 12
Table size: 37½" x 9¾"



Model No. 16
Table size: 37" x 9½"



Model No. 36
Table size: 64" x 14"



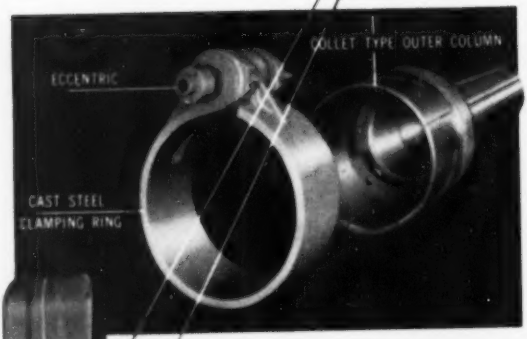
Model No. 38
Table size: 64" x 14"

SPRINGFIELD 7, MASSACHUSETTS

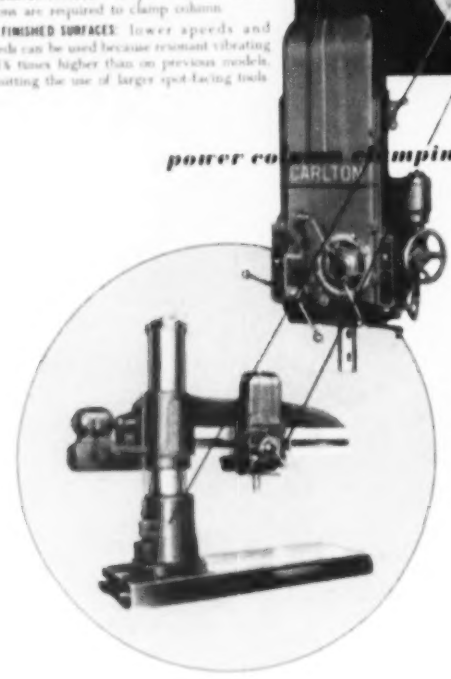
new! Carlton column clamping* device

better 6 ways!

1. **GREATER ACCURACY**: spindle displacement or movement when clamping column reduced to a maximum of .001".
2. **39% MORE RIGIDITY**: in the machine due to new column clamping device.
3. **INCREASED WORK CAPACITY**: full 360° clamping on large area between inner and outer column.
4. **FASTER OPERATION**: less time required to locate tool accurately in layout or jig work.
5. **LESS OPERATOR FATIGUE**: with push button control, few motions are required to clamp column.
6. **BETTER FINISHED SURFACES**: lower speeds and lighter feeds can be used because resonant vibrating point is 1¾ times higher than on previous models, thus permitting the use of larger spot-facing tools.



power co... ...mping controlled by push button



Carlton's new Column-Clamp* . . . the most significant advance in the technique of column clamping in years . . . can now be revealed. We are announcing it today – at a time when our backlog of orders is the largest since World War II – because we think this development is so important that every radial buyer should be acquainted with it.

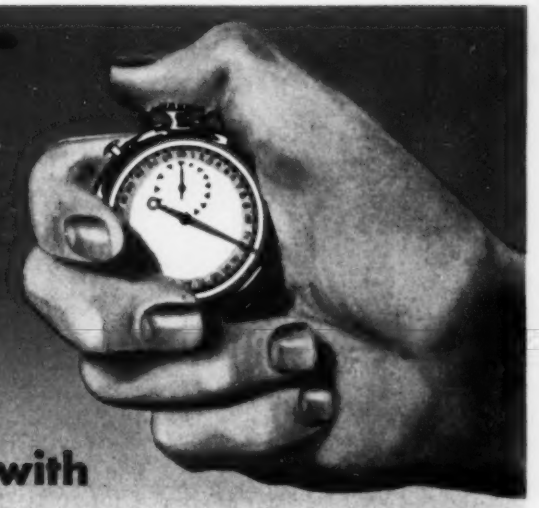
The Carlton Column-Clamp* has been thoroughly tested in the field. Wherever it has been used, it has been enthusiastically acclaimed as superior to all other radial column clamping devices past or present.

An additional accurate power clamp is provided for clamping the head tightly to the arm. Both the head and column may be clamped by power from the same push buttons, or each power clamp can be operated independently.

* Patent pending

THE CARLTON MACHINE TOOL CO.
CINCINNATI 25, OHIO

Cut Press "Down Time" with



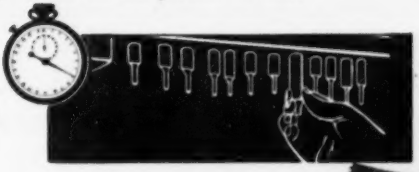
R-B* INTERCHANGEABLE PUNCHES and DIES

EASY TO REMOVE

Insert tanged tool, release ball bearing retainer lock, and out comes the punch or die.

EASY TO INSERT

Just a push and a twist and the punch or die is securely locked and accurately aligned.



R-B standard punches and dies are stocked for immediate delivery Punches and dies of special sizes, shapes and materials made promptly to your specifications.

*Richard Brothers

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ALLIED PRODUCTS CORPORATION

RICHARD BROTHERS DIVISION

DEPT. 51 • 12625 BURT ROAD • DETROIT 23, MICHIGAN

Also Produced in Allied's Four Plants . . . **HARDENED AND PRECISION GROUND PARTS • STANDARD CAP SCREWS • SPECIAL COLD FORGED PARTS SHEET METAL DIES • ALLITE DIES CAST OF ZINC ALLOY • JIGS • FIXTURES**

TAKE A LESSON FROM THE BIG USERS . . . TRIPLE PRODUCTION WITH ROBERTSON WHEELS

Cost-conscious and production-wise manufacturers the country over have been quick to take advantage of Robertson Wheels . . . so as to benefit from the longer wheel life, increased production and lower power consumption they make possible.

The following experience of a motor shaft manufacturer is typical of many users of Robertson Wheels.

Using a conventional wheel on his Landis Cylindrical Grinder to remove .015" to .020" stock from SAE 1040 steel, and held to a tolerance of plus .001" minus .000", he was able to finish only 10 pieces per wheel dressing. Wheels were being worn out excessively fast by too many dressing and truing operations; and production was slowed by the resulting work stoppages.

A Robertson Engineer, called in for advice, recommended substituting an 18" x 2" x 5" RA 462-MV Robertson Wheel. With no other change in grinding method, *production immediately jumped to*

30 shafts per wheel dressing. Here was a threefold increase in production, and longer wheel-life to boot!

The manufacturer, of course, was delighted—as so many are, once they find how Robertson Vitrified and Resin-Bonded Grinding Wheels take the tough jobs in their stride. For proof, *blueprint* your grinding problem and let us recommend a wheel for the job. Then compare the results you get from a Robertson with those of a conventional wheel.

Today, some of the country's largest manufacturers are using Robertson Wheels and Robertson engineering services. Their names will be sent on request.

ROBERTSON MANUFACTURING COMPANY

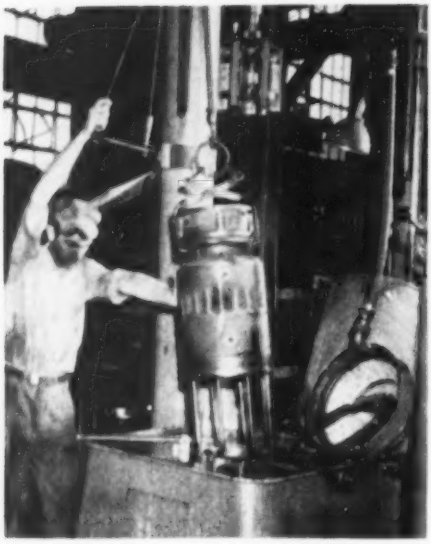
TRENTON 5, NEW JERSEY

ROBERTSON COOL-CUT

Resin-Bonded and Vitrified-Bonded Grinding Wheels • Mounted Wheels • Segments

Now! MAKE ONE SOURCE

RESPONSIBLE FOR YOUR HONING RESULTS



FULMER SUPPLIES

HONING MACHINES

Fourteen models cover diameters from 1/4" to 30". Strokes to 84".

HONING TOOLS

Alexander Ball Tools available in sizes to 50".

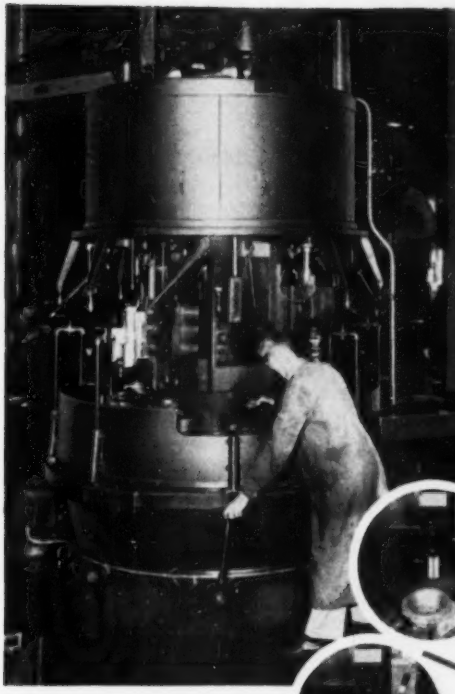
HONING FIXTURES

Why divide responsibility for the performance of your honing operations among several suppliers? Fulmer supplies a *complete honing package* — honing machine, tools and necessary fixtures—giving the user *one* source that *guarantees* best honing results!

Fulmer Honing Machines are engineered to give maximum production with minimum investment. They are known for rapid stock removal and extreme accuracy. Quick change over for various size jobs. The machines are simple to operate—easy to set up—many users have unskilled labor operating them efficiently.

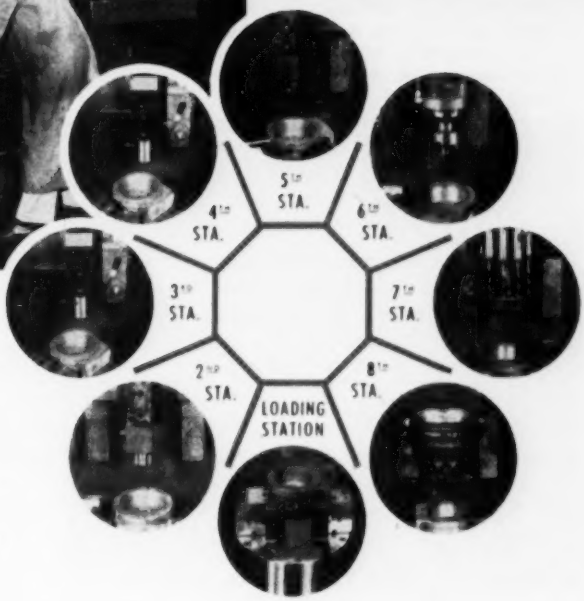
Save on production time, cut costs and improve quality on finishing all classes of cylindrical bores with a *Fulmer Honing Package—it offers the greatest value* in the honing field. Write for Bulletin No. 10 and full details.

C. ALLEN FULMER CO. 1233 FIRST NATIONAL BANK BLDG., CINCINNATI 2, OHIO



A KEY UNIT TO LOWER COSTS

Whether Mult-Au-Matics are tested for Versatility on a variety of the shorter run jobs or tested for volume production, users have for many years proclaimed these machines, "Key units in lowering our manufacturing costs".



1st Station—
Loading

2nd Station—
Rough Bore—Three Diameters

3rd Station—
Rough Face—Three Surfaces

4th Station—
Finish Face—Three Surfaces

5th Station—
Finish Bore—Three Diameters and Chamfer

6th Station—
Precision Bore—Two Diameters

7th Station—
Multiple Drill—Ten Holes

8th Station—
Multiple Tap—Ten Holes

Many of today's economic problems are being solved through lower manufacturing costs. A Mult-Au-Matic installation may be the solution to some of YOUR PROBLEMS.

Let Bullard engineers study your manufacturing methods with a view towards reducing your manufacturing cost via the Mult-Au-Matic Method. Write for Mult-Au-Matic "Pictorial"

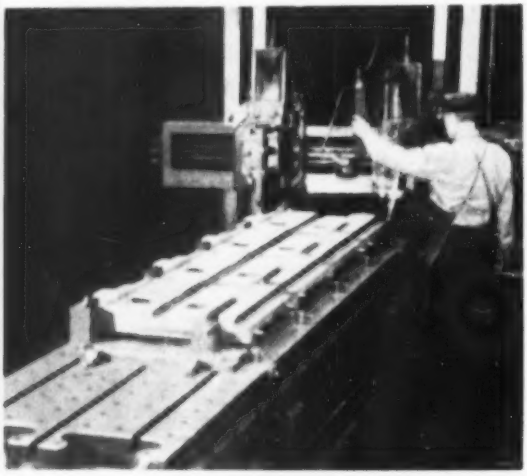
THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

CINCINNATI HYPRO PLANER

HOLDS IMPORTANT CROSS CARRIAGE BEARING SURFACES

parallel and flat!

Six horizontal and seven vertical surfaces and dovetail on each of these four turret lathe cross carriages are rough, semi-finish and finish planed and held to ±.001". Planing maintains the parallelism necessary to fit hardened and ground steel ways in subsequent assembly operations. With this Cincinnati Hypro machine using a single tool, danger of distorting or warping the intricate castings is eliminated. There is no problem of heat generation. Flatness of each part and relationship of each planed surface one to the other is easily maintained.



Typical Operations, Speeds and Feeds

1. Rough 6 horizontal surfaces and 2 lugs.
2. Rough and finish plane 2 carriage ends, using rail heads simultaneously
3. Rough 7 vertical surfaces and dovetail.
4. Repeat 1 and 3 as semi-finish operations.
5. Repeat 1 and 3 as finish operations.
6. Remove parts for subsequent machining.

Speeds:
145 F.P.M. roughing with 210' return speed
90 F.P.M. semi-finish with 190' return speed
90 F.P.M. finish with 190' return speed

Depth and Rate of Feed:
Horizontal Surfaces
Roughing 5/16" at .045"
Semi-finish 5/16" at .010"
Vertical Surfaces
Roughing 1/8" at .045"
Semi-finish 1/8" at .045"

Cutters:
Carbide tipped tools

PRODUCE *More at Low Cost* **with these other**

HYPRO MACHINES*

Openside Planers
Planer Type Milling Machines
Frog and Switch Planers
Vertical Boring and Turning Mills
Special Planers and Boring Mills

* Optional with non-metallic table ways if desired.

G&L HYPRO

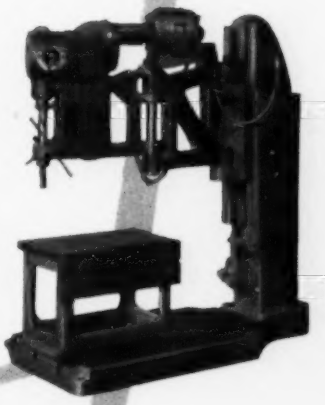
GIDDINGS & LEWIS MACHINE TOOL CO.

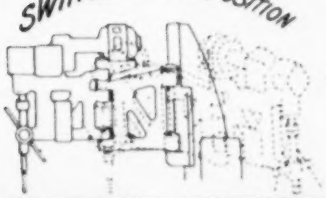
126 DOTY ST. • FOND DU LAC, WISCONSIN

ideal for miscellaneous holes

● For those miscellaneous drilled, reamed, counterbored or tapped holes the Footburt-Hammond Radial is the handiest machine in your shop. With its unique bracket type design the spindle quickly swings from hole to hole over a wide area. Six instantly changed speeds are available and the convenient electrical reverse really speeds up tapping work. Write for full information.

THE FOOTE-BURT COMPANY, Cleveland 8, Ohio
Detroit Office: General Motors Building





—FOOTBURT-HAMMOND— RADIAL drilling machines——

a time tested line of machine tools

Buckeye

50 Years Service to Industry

• Quality in bronze bearings is no accident. Since 1900 Buckeye has been a pioneer in every bearing advancement.

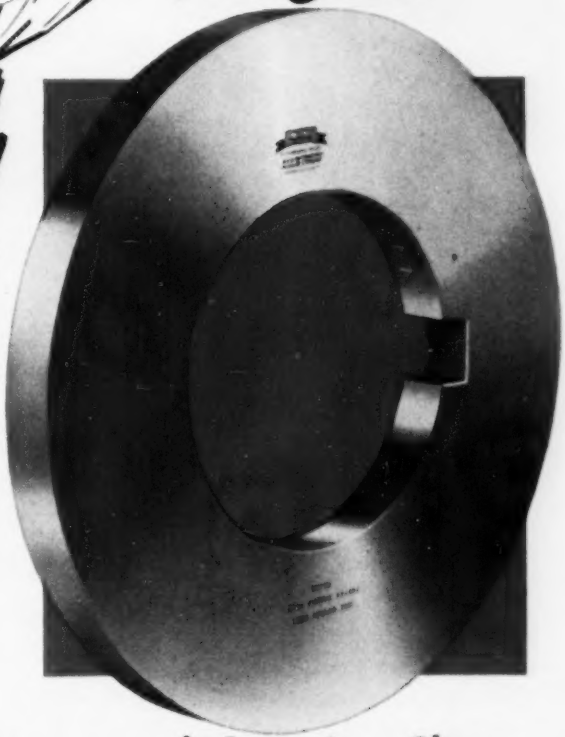
Your nearest Buckeye Distributor is a recognized authority. From his adequate stocks of Buckeye Standard Stock Bushings and Fully Machined Maintenance Bars your needs can be served best. The Buckeye Brass and Manufacturing Company, 6410 Hawthorne Avenue, Cleveland 3, Ohio.

"Save with SIMONDS" Forged

Rotary Shear Knives

So says anyone who slits any type of sheet or strip metal. For they *know* that these "Red Streak" Knives cut straighter, cleaner, *and longer between sharpenings* . . . because they're forged and micro-finish ground. Forging condenses the grain structure — prevents nicking. Micro-finish grinding permits non-ferrous metal slitting without "pick-up."

Designed for specific shearing applications, these long-lived knives are made from 3 types of steel forged in Simonds' own mills . . . High Chrome, Special Alloy and High Speed. Send for free "Shear Selector" chart or ask for a "Simonds Man" to help with your slitting problems.



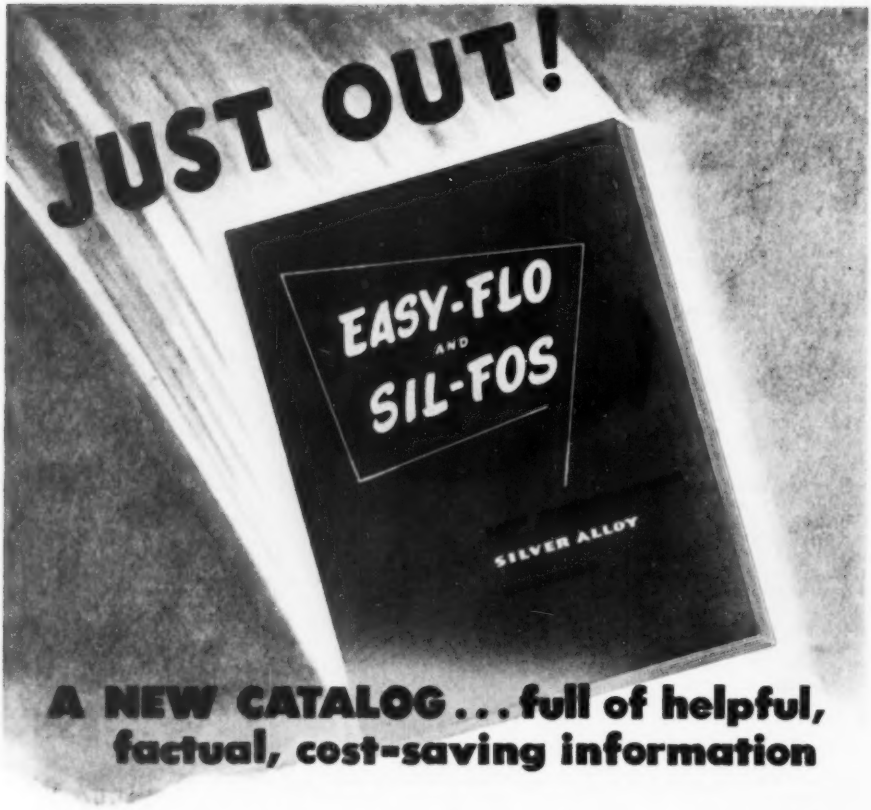
Cross-section showing "Tungsweld" High Speed Steel inlaid cutting edge

. . . and Squaring Shears

This "Tungsweld" Squaring Shear far outlasts other types . . . causes less down-time . . . gives far faster, cleaner shearing of tin plate, silicon, monel, stainless and other thin sheet metals . . . all because of Simonds' special method of welding a high-speed steel inlay to tough steel backing. Order a set today made to your exact specifications and "Save with Simonds."

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

BRANCH OFFICES IN *Boston, Chicago, San Francisco and Portland, Ore. Canadian Factory in Montreal, Que.*



A NEW CATALOG... full of helpful, factual, cost-saving information

It's a storehouse of facts and data—28 pages of useful information by the originators of EASY-FLO and SIL-FOS. Tells WHERE and HOW to use these silver brazing alloys to the best advantage; shows many time-tested applications; describes fast brazing techniques; tells how you can speed up production and **save.** It's a "must" for all who design or produce metal assemblies.

WRITE FOR YOUR FREE COPY TODAY. ASK FOR BULLETIN 20.

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How Bliss Engineers helped Clemson Bros., Inc. produce new lawnmower

Outer Wheel Discs of .049 steel are blanked and formed...54 a minute, in No. 28 press with Bliss double-roll feed, scrap shear and die cushion. Special cam KO speeds ejection of disc. Stock is automatically fed from Bliss coil cradles with seven-roll straightener. A loop control starts and stops stock exactly as required.

Customer's Cost Kept Down by Bliss Recommending Both Equipment and Methods

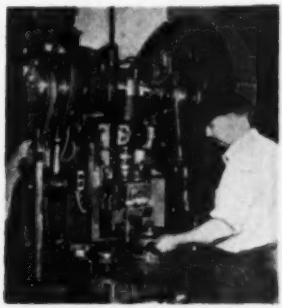
When Clemson Bros., Inc., of Middletown, New York, decided in 1947 to produce a new light-weight lawnmower featuring pressed metal stampings, they invited Bliss to recommend equipment and methods. Assuming responsibility for both presses and dies, Bliss prescribed equipment with high-production capacity requiring a minimum of manpower. Beyond this, Bliss helped Clemson hold capital investment at a minimum by offering its standard general-purpose inclinable presses fitted with special Bliss feeds and other accessories.

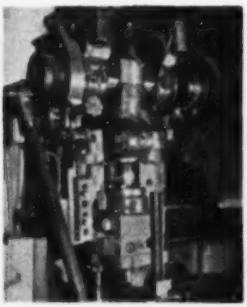
Concluding a highly successful first year manufacturing the new lawnmower, Clemson's production manager says: "Our Bliss presses have proved themselves to be highly efficient machines on large and small jobs. We have had little maintenance; they have actually been trouble-free. All the Bliss feeders have functioned perfectly since the day they were put in operation."

As the world's largest manufacturer of all types and sizes of presses, Bliss is in a unique position to counsel on the selection of the right press for a given job. Next time you have a metal-stamping problem, ask Bliss about methods and equipment. Your Bliss representative will welcome the opportunity to service your requirements.

E. W. BLISS COMPANY, CANTON, OHIO

Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery





Operator Cares for Two Presses. Bearing cups are semi-coined from .080 steel blanks (left) in No. 20-B press with automatic stack feed. Finish coining and punching is done at right in geared 20-B press with 20-station dial feed. Production is 32 a minute.

JUST OFF THE PRESS!

Completely New

700 Pages

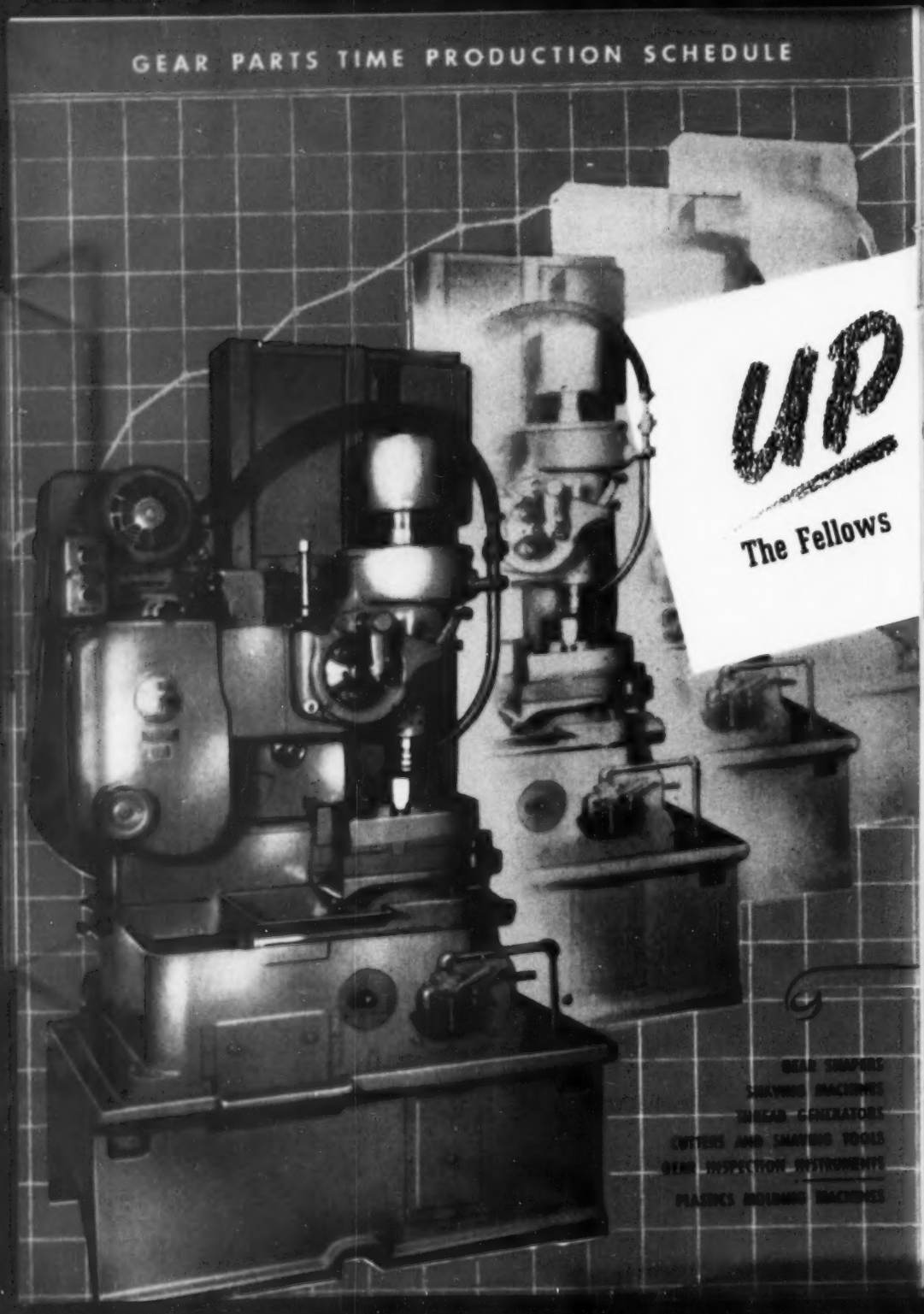
450 Illustrations

Sections on: Easy methods of computing press jobs · How to select the proper type of press · Useful engineering tables · Die illustrations · Glossary of terms used in the pressed metal industry.

Plus a complete service section covering all types of Bliss presses, old and new. $7.50

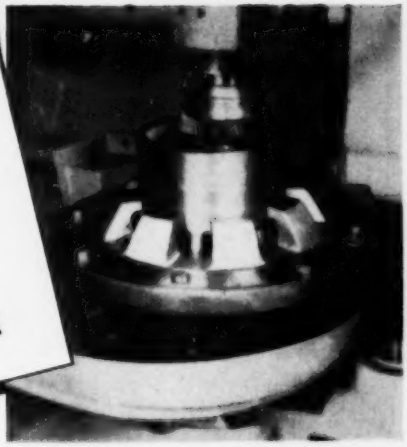
E. W. Bliss Company—Handbook Dept.
Canton, Ohio

From a single press for a given job to a complete press room — *It's Bliss*


GEAR PARTS TIME PRODUCTION SCHEDULE
UP
The Fellows

GO TIME SAVING POSSIBILITIES

7A-Type Gear Shaper sets a Production Pace for 1951



For an internal gear part an air-operated diaphragm-type chuck like this makes loading and unloading a simple operation—for stop-watch timing.

- **AUTOMATIC QUICK-STOPPING OF CUTTER-SPINDLE RECIPROCATION**
- **AUTOMATIC POSITIONING OF CUTTER AT TOP OF STROKE (without coasting)**
- **AIR-OPERATED QUICK CLAMPING CHUCK**

Due to its amazing versatility, the 7A-Type Gear Shaper is able to compete with other production machines on a floor-to-floor time saving basis. High cutting speeds and precision control have always been there. To these advantages have been added speed-up of work handling, quick-acting work holding devices, etc.

The machines illustrated are set up to cut cast iron internal helical gears 27/32" face width, 16 pitch, 20° pressure angle, 79 teeth (5.1313" p.d.)—and to finish each gear in 2 cuts in 5 minutes floor-to-floor time.

If your requirements are not sufficiently large to require the enormous production possibilities of the 10-spindle Rotary Gear Shaper, let us work out time estimates based on 7A-Type Machines with the latest auxiliary modifications. Write, wire or phone the nearest Fellows engineering-sales office.

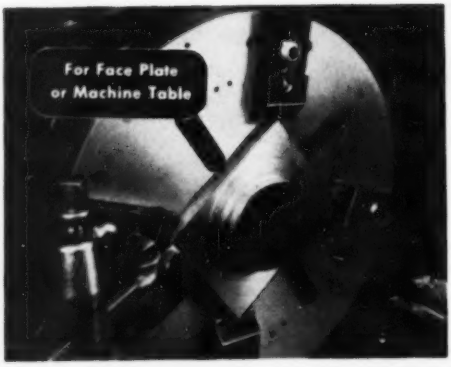
Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont
Branch Offices: 616 Fisher Bldg., Detroit 2 • 640 West Town Office Bldg., Chicago 12 • 2206 Empire State Bldg., New York 1.

PRODUCTION RATES CLIMB with NEW J & S JAW CLAMPS

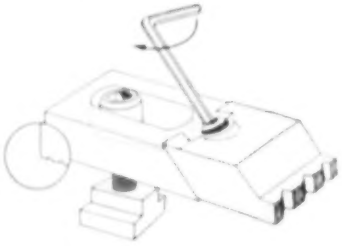
J & S "All-Purpose" JAW CLAMPS

Eliminate **U - Clamps, Straps & Fingers — also, in *most* cases, eliminate 4-jaw chuck, vises and special fixtures! For lathes, planers, milling machines & drill presses.**



Typical lathe application. Work-piece removed by simply loosening one screw in each of two adjoining clamps. NO RE-POSITIONING NECESSARY for next piece.

Fastest, simplest—work-pieces held rigidly. Less obstruction, no slipping because a 1/16" *tapered slot insures firm grip*. Also, angle of jaw travel is 45° to plane of the face plate or table. As the screw is tightened, the jaw forces the work-piece *down* against the machine surface—*across* against the opposite clamp—this grip is *stronger than that* provided by *eight* U-clamps!



Tested for two-ton down pressure, completely hardened.

As the drawing shows, jaws of the standard J & S Clamp are only 23/64" thick — allows overall machining to within ⅜" of the machine's working surface! Available in types and sizes to suit all applications. "T" nuts furnished to fit all standard machines.

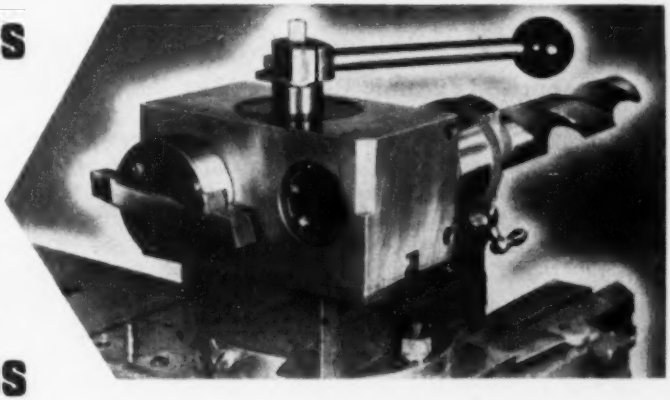
J&S TOOL CO., INC.
475 Main Street East Orange, N. J.
Representatives in Principal Cities

WRITE FOR NEW FOLDER!

—Contains complete details on advantages, applications, types and sizes available. "Time Saver" booklets, describing J & S "Fluidmotion" Wheel Dressers, etc., also on request.

GET RESULTS!

Set Tools By Gage NOT By Guess



To get the most out of your lathe, the most versatile machine in your shop, you must bring its tooling up to date. The tool-post on the lathe is as antiquated as the horse and buggy—it served its purpose well, but the time has come to abandon it. Today's demand for higher production from all machines makes no exception of the lathe. Output from the lathe can be increased by as much as fifty per cent by use of the WYRICK TOOL SERIES.

✔ Check These Features

- **A SINGLE BASIC TOOLHOLDER** for all tools used on the lathe.
- **A RIGID SUPPORT** for all tools, reducing vibration to a minimum.
- **RAPID INTERCHANGEABILITY** of tools and insured accuracy in resetting.
- **TOOLS SET BY GAGE — NOT BY GUESS.**
- **MULTIPLE OPERATIONS** from one tool, saving time usually wasted changing tools and resetting.
- **ELIMINATION OF TAIL-STOCK TOOLING** which is hand fed and always slow.
- **POWER FEED** all operations, either radial or center type.

The WYRICK TOOL SERIES is as modern as tomorrow. The guesswork has been taken out of tool setting. Fewer tool set-ups are required; changing from one tool to another is now easily, quickly and accurately accomplished.

The WYRICK TOOL SERIES provides a more rigid method of holding tools, allows faster tool changing and unlimited tooling possibilities.

STOP SPENDING MORE TIME SETTING TOOLS THAN YOU DO IN REMOVING METAL

Write For Illustrated Folder Giving Detailed Description

EDBERT TOOLS CORPORATION

2531 N. W. 79TH STREET
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Inquiries invited from Manufacturers' Agents

PATTERN FOR PEAK PR
AT A PROFIT

For Important Reductions in Machining Time . . . For Accuracy Exceeding Other Production Turning Means . . . The Monarch Air-Gage Tracer

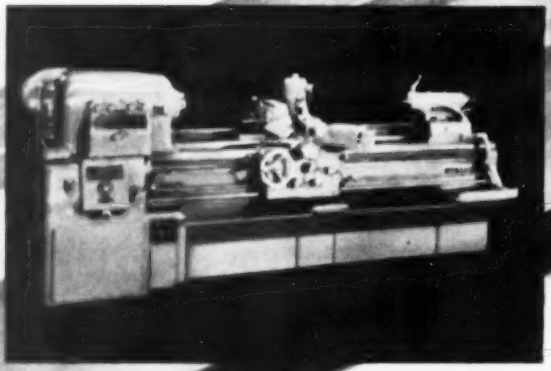
Look it over! Monarch's 21 years of experience with tracer controls brings you today's Monarch Air-Gage Tracer with every one of these performance features (right). Here is a simple, cost-reducing production method for turning machines. It is recommended for turning multiple diameter shafts and turning, boring or facing contours with a versatility making it adaptable to a large variety of turning operations. And it provides accuracy far exceeding any other lathe duplicating method.

Every Monarch Air-Gage Tracer user knows that these advantages show dollars-and-sense reasons for obsoleting less efficient turning methods—making the change pay off *fast!* You'll know, too, when you examine the complete data in our Bulletin No. 2606. Ask for it—and/or the other Monarch Tracer Control Methods described in the convenient coupon. *The Monarch Machine Tool Company, Sidney, Ohio.*

Monarch

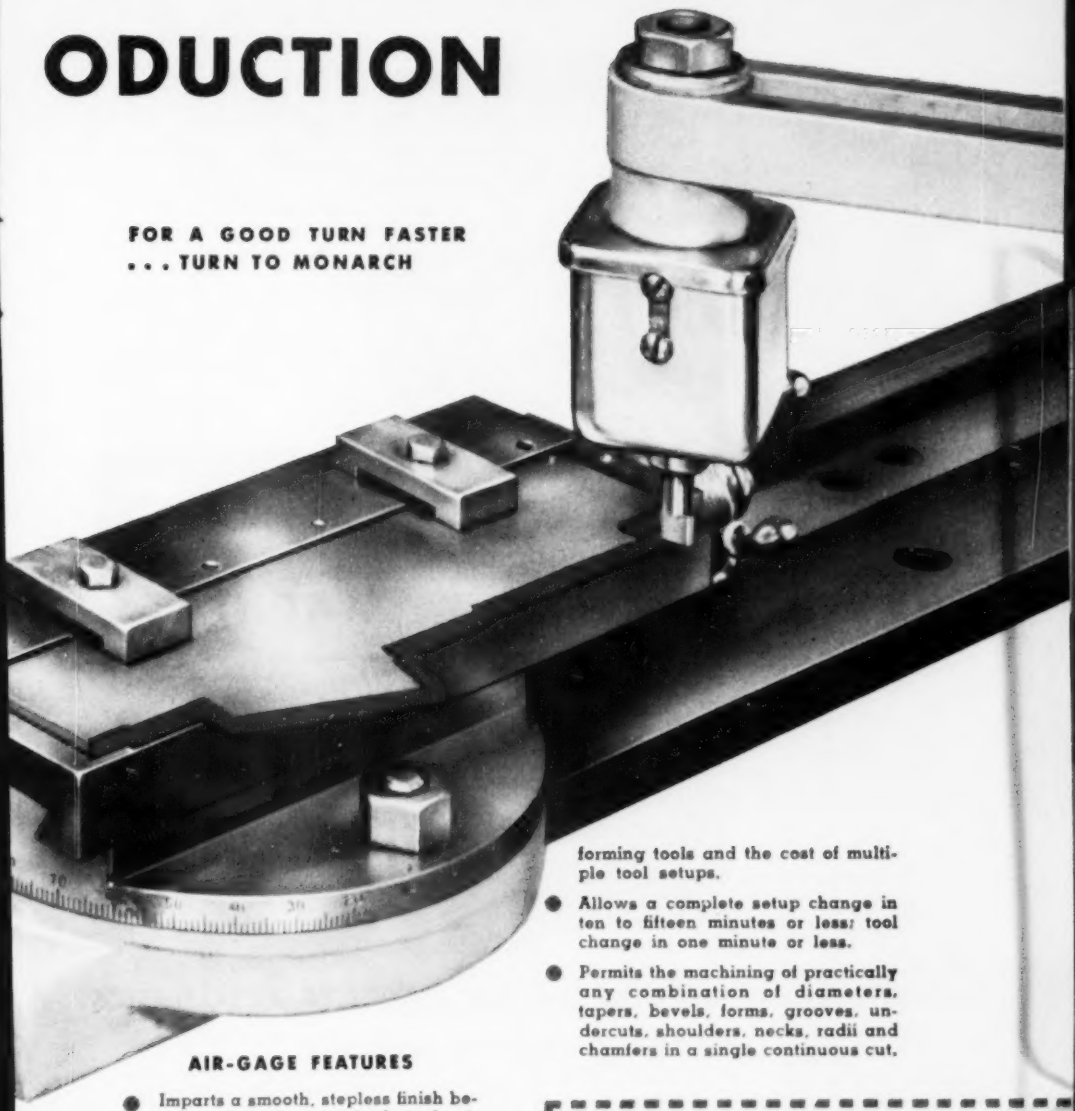
ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES



ODUCTION

FOR A GOOD TURN FASTER
. . . TURN TO MONARCH



AIR-GAGE FEATURES

- Imparts a smooth, stepless finish because of continuous, single tool cut.
- Generally reduces by half the amount of stock left for grinding.
- Often eliminates hand polishing or grinding because of the fine finish imparted to the work.
- Reproduces template form on work more accurately than any other duplicating device.
- Eliminates the need for expensive forming tools and the cost of multiple tool setups.
- Allows a complete setup change in ten to fifteen minutes or less; tool change in one minute or less.
- Permits the machining of practically any combination of diameters, tapers, bevels, forms, grooves, undercuts, shoulders, necks, radii and chamfers in a single continuous cut.

THE MONARCH MACHINE TOOL CO.,
Sidney, Ohio

Gentlemen: Please send without obligation the following complete Bulletins:

- ☐ **Bulletin No. 2606—The Monarch Air-Gage Tracer**
- ☐ **Bulletin No. 2302—The Monarch Motor-Trace**
- ☐ **Bulletin No. 2401—Monarch-Keller Controls**

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COMPANY _____

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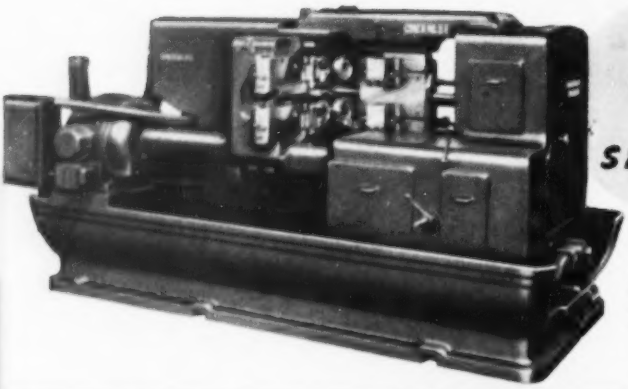
CITY _____ ZONE ____ STATE ____



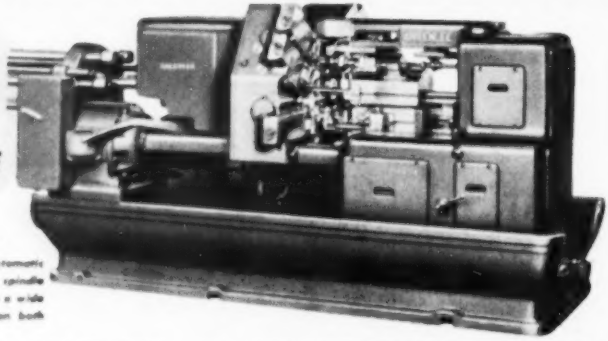
4 SPINDLE

THE GREENLEE "FOUR"
A heavy-duty automatic made in 1⅝" and 3½" spindle capacities. The "Four" incorporates all the cost-cutting features of the well-known "Six" (see below).

GREENLEE

AUTOMATIC SCREW MACHINES

6 SPINDLE



THE GREENLEE "SIX"
A ruggedly-built, high-speed automatic . . . available in 1", 1½", and 2" spindle capacities . . . capable of handling a wide range of work . . . widely used on both short and long-run jobs.

OUTSTANDING FEATURES OF ALL GREENLEE AUTOMATICS

Write for literature describing in detail all the features of Greenlee Automatics

PRODUCTION MACHINERY
GREENLEE

UNIVERSAL TOOLING — Tool holders fit any cross-slide cavity . . . are easily and quickly changed . . . reduce equipment costs.

INTERCHANGEABLE CAMS — Can be changed at will without re-adjustment of tools and holders. Cam storage is held to a minimum . . . cam costs greatly reduced.

BUILT-IN THREADING DRIVE AND FEED — Not an extra attachment, but standard equipment on Greenlee Automatics.

BUILT-IN COOLANT SYSTEM — Eliminates cumbersome piping in tooling area . . . gets coolant right where it does the most good.

LARGE TOOLING AREA — Permits using many timesaving, cost-cutting auxiliaries that often eliminate second operations.

Various special adaptions of standard Greenlee Automatics can be made . . . for handling second-operation work . . . for tooling extra-long work pieces . . . for multiple feed-out arrangements, etc.

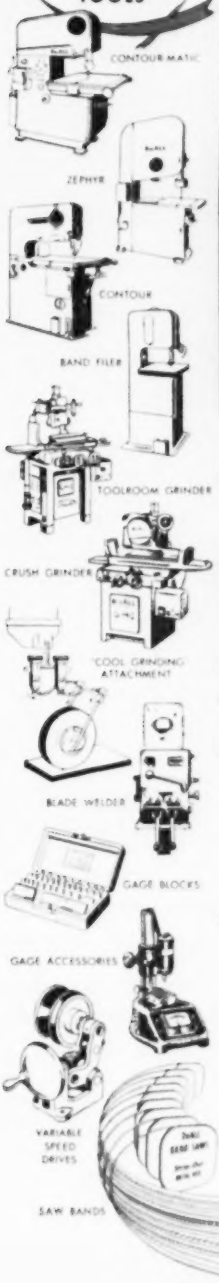
Send us details of your work. Let our engineers show you how profitably Greenlee Automatics can be applied to your production.

GREENLEE BROS. & CO., 1881 Mason Ave., Rockford, Ill.

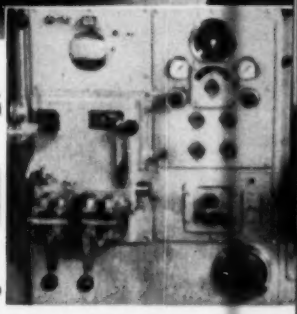
MULTIPLE SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

DoALL

INDUSTRY'S NEW SET OF TOOLS



42 HOURS SAVED over any other machining method. This 327 lb. High Tensile Iron Forming Die was band machined on the DoALL Contour-matic.



BETTER THAN A MACHINE TOOL

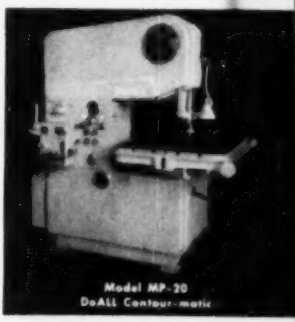
The new DoALL Contour-matic is the first Band Machine that is a true production machine tool.

1. Has the rigidity of a machine tool.
2. Has a traveling work table.
3. Has centralized hydraulic controls.
4. Operates with minimum human effort.

AND it goes beyond a machine tool

1. Cuts every known material.
2. Has a wider range of tool speed.
3. Uses 27 kinds of cutting tools.
4. Saves time and material by cutting directly to a layout line.

Write for a demonstration—
See it work on your own jobs



Model MP-20
DoALL Contour-matic

TOOL STEEL

BENCH FILER

The DoALL Company

Des Plaines, Ill., U.S.A.

Cable Address: DoALL, Des Plaines

DoALL Stores in Key Cities

Factory Trained Representatives Everywhere

HELLER

NUCUT WAVY TEETH FILE

. . . it's different

. . . it's patented

. . . it's the only file that gives double-duty filing action

It's the patented Heller Nucut "Wavy Teeth" feature that makes the difference. This cut-and-smooth two-in-one filing design incorporates two sets of *scientifically* positioned teeth – one coarse, the other fine.

With every stroke of a Nucut, the coarse teeth take deep, clean, uniform cuts. The fine teeth leave a smooth finish – just as though TWO files were working instead of ONE.

That means you can remove more metal faster, easier, and get a smooth finish without clogging, skidding or scraping! Write!

HELLER BROTHERS COMPANY

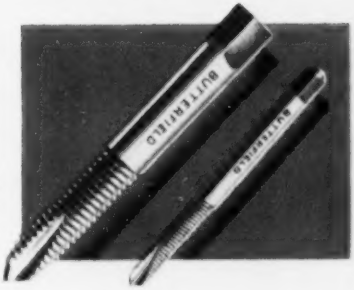
America's Oldest File Manufacturer

Newcomerstown, Ohio

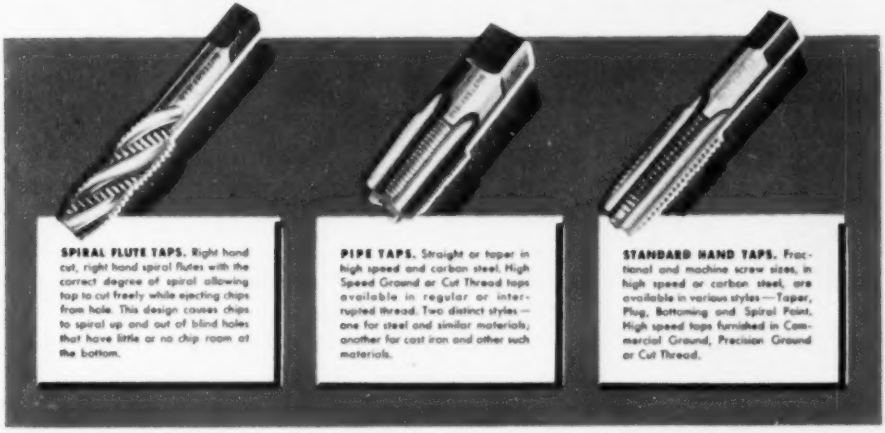
Ask also about our COMPLETE LINE of Swiss Pattern, Vixen Milled Curved-Tooth and Rotary Files, Rasps, Carpenters', Machinists', Tinners', Upholsterers', Bricklayers', Tilesetters', Blacksmiths' and Farriers' Hammers. Also Bricklayers' and Plasterers' Trowels, Craftsmaster Scrapers, Chisels, Punches, Masterenches and other quality tools.

Butterfield Announces the Newest. . .

STUB FLUTE PRODUCTION TAPS. Especially designed for threading holes in thin sections, where depth of thread required is no more than the tap's diameter. Available in High Speed Commercial Ground fractional sizes (left) and machine screw sizes (right), these rugged, hard-hitting production taps are made to standard dimensions of spiral pointed taps, except for the short stub flute that provides extra strength.



in a famous line that includes. . .



SPIRAL FLUTE TAPS. Right hand cut, right hand spiral flutes with the correct degree of spiral allowing tap to cut freely while ejecting chips from hole. This design causes chips to spiral up and out of blind holes that have little or no chip room at the bottom.

PIPE TAPS. Straight or taper in high speed and carbon steel. High Speed Ground or Cut Thread taps available in regular or interrupted thread. Two distinct styles — one for steel and similar materials; another for cast iron and other such materials.

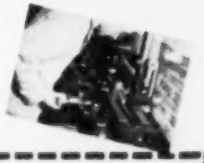
STANDARD HAND TAPS. Fractional and machine screw sizes, in high speed or carbon steel, are available in various styles — Taper, Plug, Bottoming and Spiral Point. High speed taps furnished in Commercial Ground, Precision Ground or Cut Thread.

and. . .

Stove Bolt Taps · Pulley Taps
Staybolt Taps · Boiler Taps
Nut Taps · Serial Taps · Tapper Taps
Mud or Washout Taps

All Individually Inspected . . . All Promptly Available From Your Nearby Butterfield Distributor

Checking pitch diameter, thread form and lead on a Zeiss Universal Measuring Microscope.



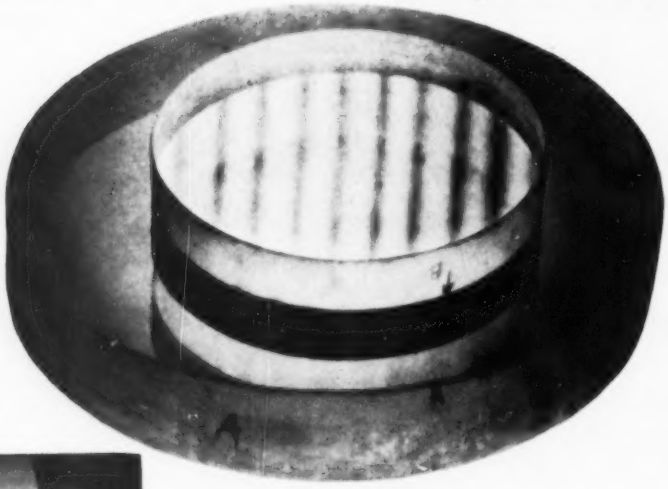
Union Twist Drill Company
BUTTERFIELD DIVISION
Derby Line, Vermont
In Canada: Rock Island, Quebec

BUTTERFIELD
THE 100% INSPECTED TOOLS
Every Tool Individually Inspected
TAPS • DIES • REAMERS • SCREW PLATES

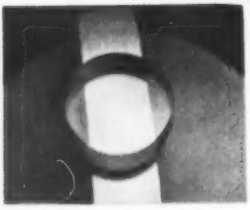
Van Keuren ... OPTICAL FLATS

are the proof of Precision

BOSTON



NEW YORK



IF the 10" diameter Van Keuren Master Flat shown above were extended from New York to Boston, the surface would deviate from a true plane less than 1".

Insist on having Van Keuren Fused Quartz Optical Flats. They are beautifully finished and are of superlative accuracy on both sides. They are the best buy.

Detecting worn spot on amplifying gage anvil.

Checking flatness of lapped shoulder on a shaft with a special 3" diameter x 29/32" hole Fused Quartz Optical Flat.

IF YOU HAVE A PROBLEM

of testing flat surfaces, send us a sample part for examination and report.

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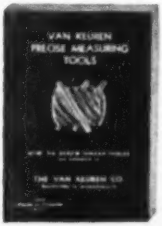
It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.



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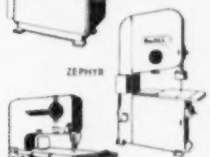
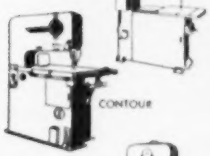
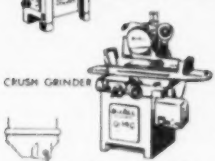

ZEPHYR


CONTOUR

BAND FILER

TOOLROOM GRINDER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"COOL GRINDING" ATTACHMENT

BLADE WELDER

GAGE BLOCKS

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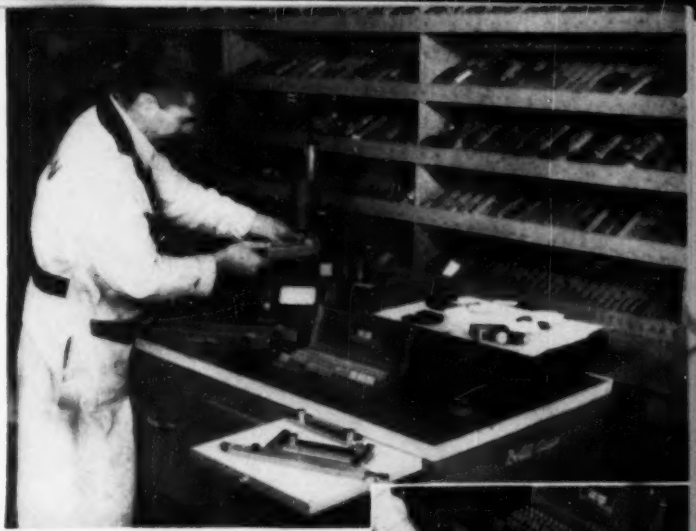
SAW BANDS



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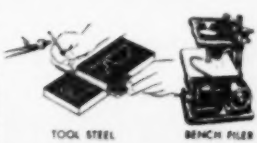
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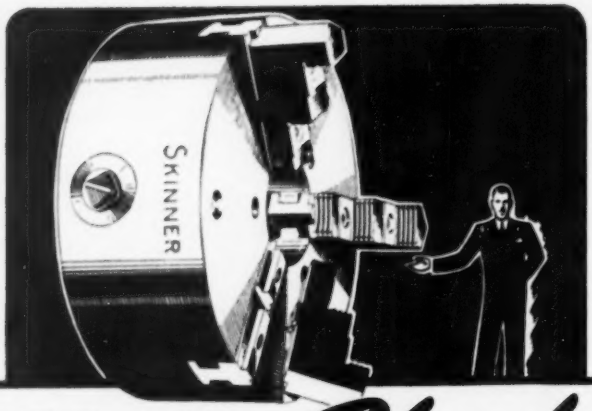

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SCROLL CHUCK

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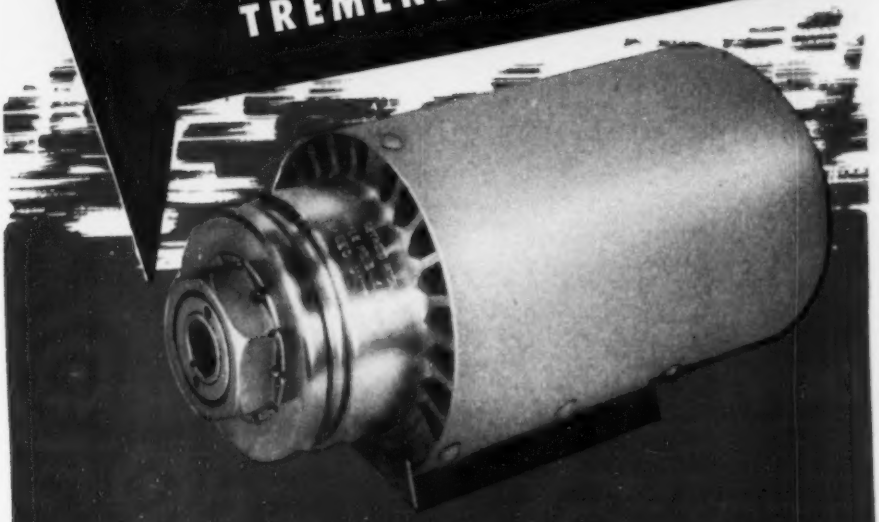
EX-CELL-O *Spindles*

"STEPPED UP PRODUCTION TREMENDOUSLY!"



That's what an electrical manufacturer says about a group of Ex-Cell-O Precision Spindles he purchased. These were of the high frequency, inbuilt motor type, pictured above. If you use precision grinding spindles send for the Ex-Cell-O Spindle Catalog today—no obligation, of course. For a quotation on special spindles just send a sketch with basic dimensions and state the speed and horsepower required.

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TOOL & CUTTER GRINDERS – DRILL POINT THINNERS – TEMPLATE TOOL GRINDERS – FACE MILL GRINDERS – DIEMAKING MACHINES

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Unique labyrinth seal automatically controls the correct amount of lubricant and prevents blowing out of seals. Keeps in lubricant while it keeps out dirt.

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Rigid, one piece, precision machined, providing a solid mounting in any position.

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Spherically ground outside bearing surface automatically aligns itself in the Boston Gear iron housing. This means accurate alignment of shafts — quick mounting, easy installation.

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Precision ground chrome alloy ball bearings and Mirror-Finished bearing steel ball races assure smooth, quiet running and long life.

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BOSTON Gear PILLOW BLOCKS and FLANGED CARTRIDGES are stocked by *eighty* experienced, competent Authorized Boston Gear Distributors — one near you.

See for yourself why...

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SAFETY-VENT-SEAL

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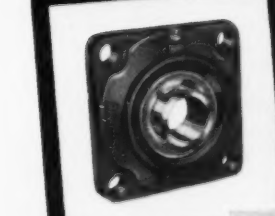
BOSTON Gear Self-Aligning, Precision Ball Bearing PILLOW BLOCKS with SAFETY-VENT-SEAL



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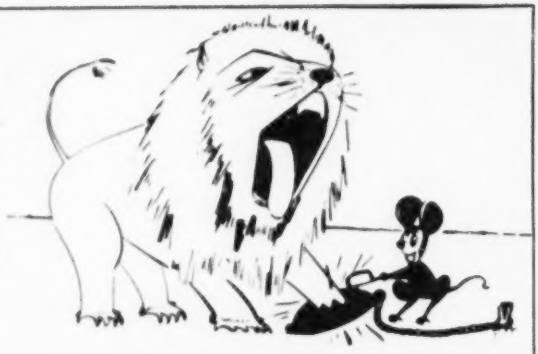

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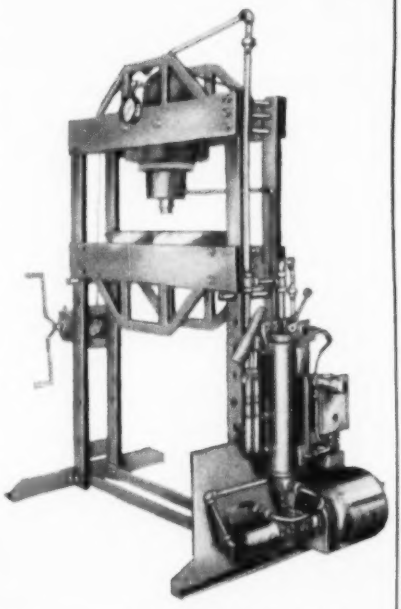

Illustrated is No. 37 MD-1 Motor Driven Hydraulic Press. One of the KRW standard line available for immediate delivery.

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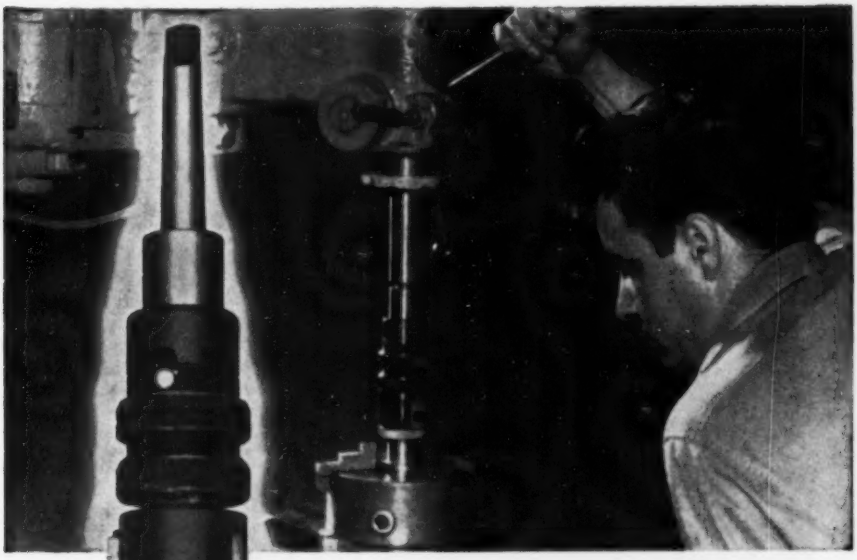

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● Cut Recessing Costs on your Drill Press . . . Boring Mill . . . Turret Lathe . . . Radial Drill . . . etc. **ALL NEW** Series "R" Maxwell Recessing Tools give unlimited versatility.

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Standard Series "R" Recessing Tools are available to cut recesses from ¼ to 4¼ inches in diameter. Write today for catalog "R" . . . .

Precision boring with MASTUR heads is described in catalog PBH. These inexpensive tools feature large capacity, adjustability and accuracy. Specifications are charted.

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THE MAXWELL COMPANY

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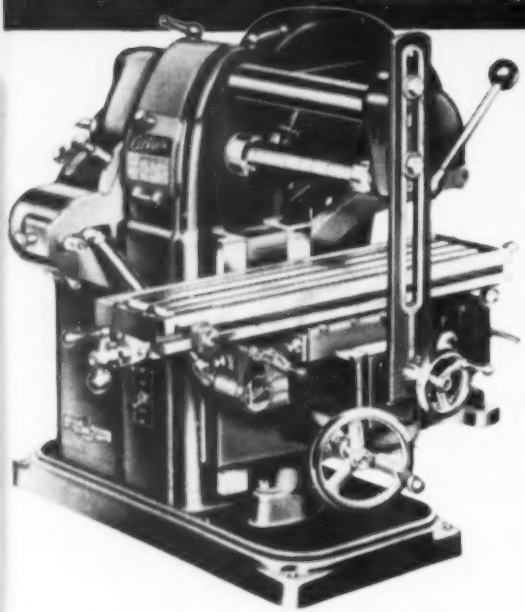
Atlas the Lowest Cost MILLING MACHINE!



- ★ Timken Bearing Equipped Spindle For Accuracy and Long Service
- ★ Backgeared Power For Heavy Cuts
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Send for detailed catalog.

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MATCHED PRECISION TOOLS FOR WOODWORKING AND METALWORKING

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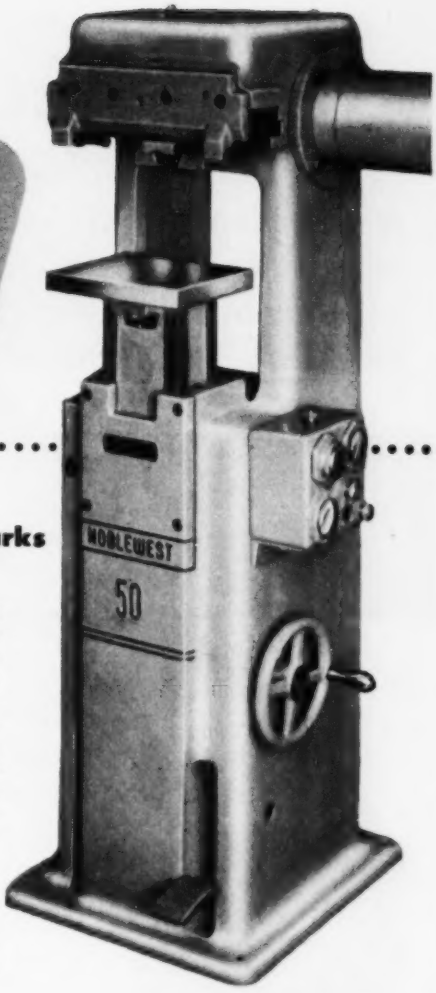

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All-pneumatic (Model 50P1) marks up to 1200 pieces per hour

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Introduces

a grinding spindle with ball raceways ground directly into the shaft

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- ★ Gives the ultimate in precision and finish
- ★ Ensures minimum chatter
- ★ Ensures concentricity of wheel mounting with axis of rotation

Ball raceways of this new spindle, ground directly into the shaft, carry both annular and axial thrust. Virtually eliminated is run-out of wheel mounting thimble, a fault frequently encountered in spindles with built-up bearing assemblies. Furthermore, because of this new feature, the spindle construction is far stronger and heavier.

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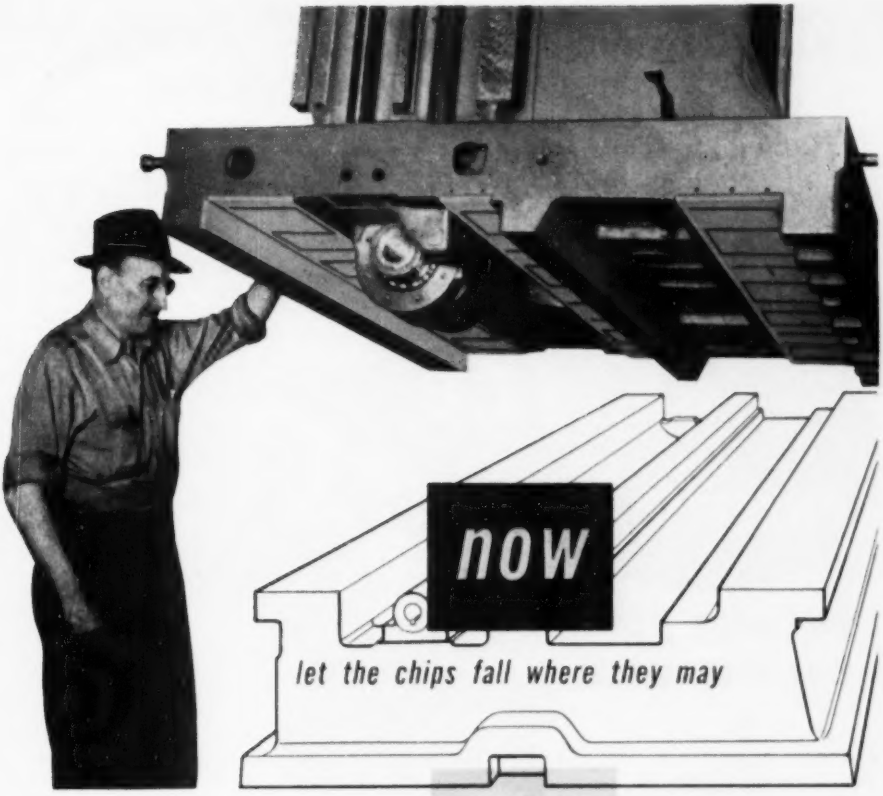
T-P means TOP PRECISION



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NON-METALLIC WAYS

. . . extend service life far into the future. Now Cincinnati Gilbert brings you non-metallic way blocks between the column base and the runway in Floor Type Horizontal Boring Machines. Field tests indicate that with average lubrication and cleanliness this development extends service life of the ways almost indefinitely. Wear is negligible and accuracy is maintained . . . This is just another of many reasons for specifying "CINCINNATI GILBERT" on your next Horizontal Boring Mill purchase . . . The Cincinnati Gilbert Machine Tool Co., 3360 Beekman Street, Cincinnati 23, Ohio.

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"IS YOUR PROBLEM ...HOW TO CUT PRODUCTION COSTS"

THE ANSWER IS ....

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MATCHED FOR THE JOB

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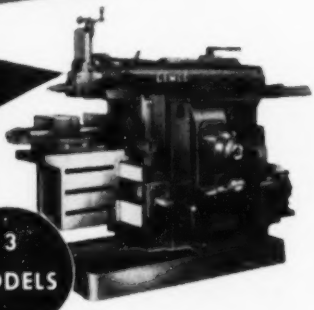
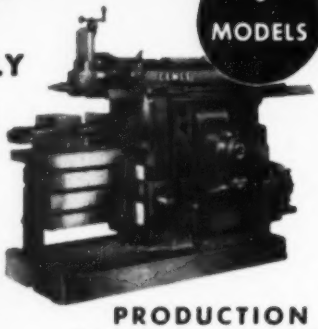
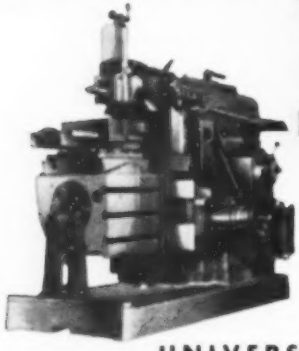


and **BEAT COSTLY OBSOLESCENCE!**





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Indicated for general machine shop use and heavy production work. In sizes from 16-in. heavy duty to 36-in. standard duty and with separate Table and Apron and with Front Table support. LUBRIGARD protected.

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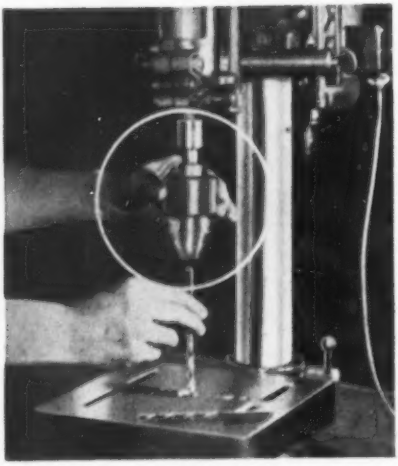
Change drills in a second, safely with this Automatic Chuck while spindle is running



AMF Wahlstrom Chucks are rugged tools, proven out in many years of heavy production work. Simple construction assures ease of operation.

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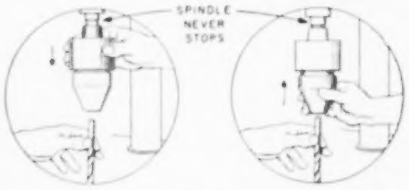

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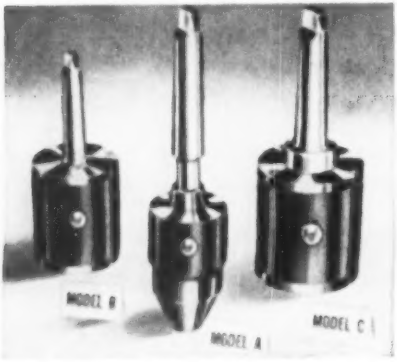

Wahlstrom Chucks are available in several size ranges:
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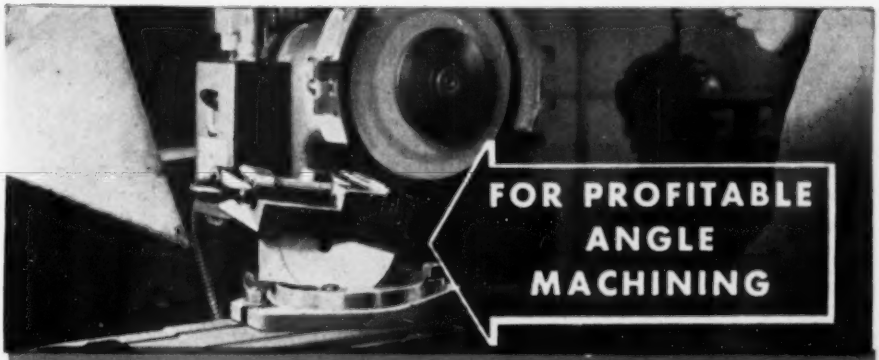

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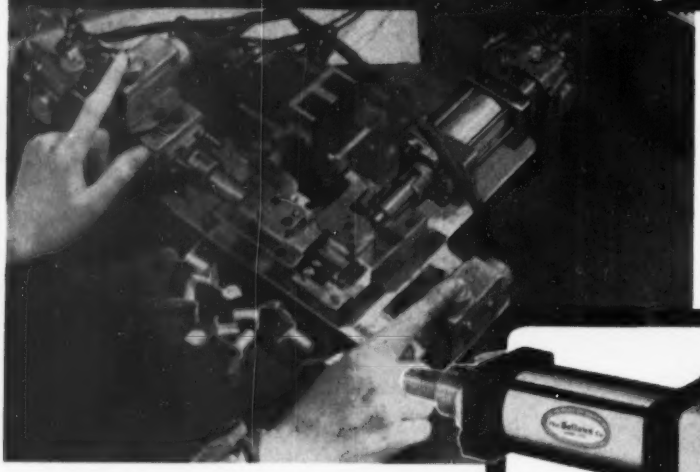

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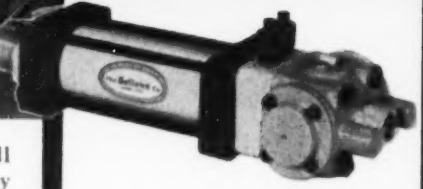

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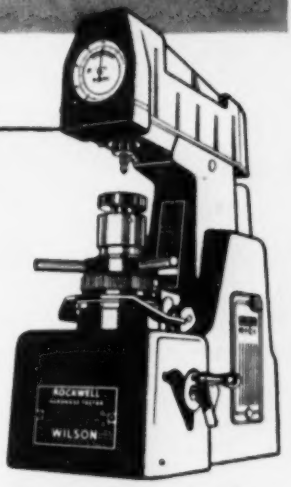

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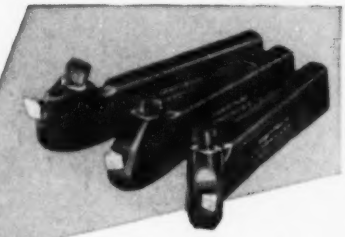

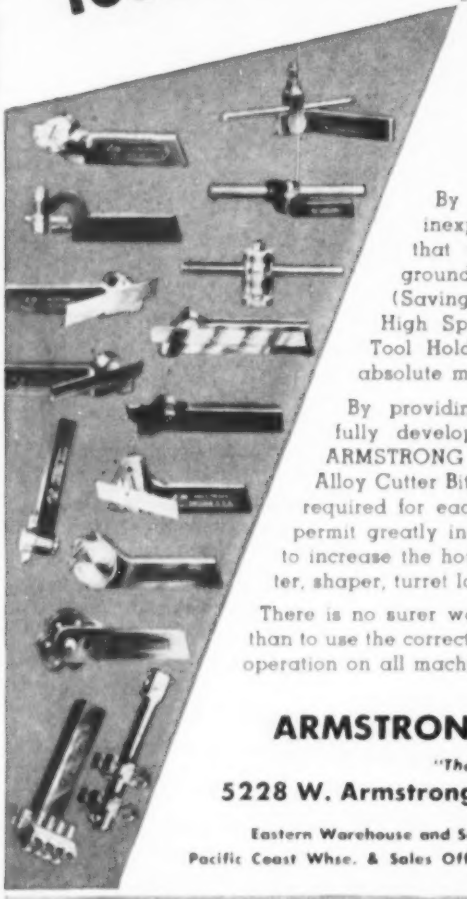

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MODERN
Machine Shop

JANUARY, 1931 • Vol. 23, No. 7

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By Bartlett West

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Practical Toolmaking, Part I *By J. Y. Riedel*

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Quality Control Pays Off in Assembly Operations *By C. W. Kennedy*

A presentation of helpful data, including easy-to-understand charts and graphs, for use in controlling the number of rejected workpieces in final assembly operations. Page 144.

The Hygiene of Modern Abrasives *By Henry R. Power*

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Fitting Metal Cleaners to the Job *By Gilbert C. Close*

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Reducing the Cost of Permanent Tooling *By Frank Charity*

Mr. Charity describes techniques for obtaining permanent production molds and dies at costs comparable to expenditures normally made for temporary tooling. Page 202.

Application of Metal Cutting Research to Shop Practice, Part I

In which the author presents a practical method for determining proper machining feeds and speeds.

By Dr. Max Kronenberg
Consulting Engineer, Cincinnati, Ohio

THE critical world situation calls for supreme effort on the part of American manufacturers to speed up production. As far as the metalworking industry is concerned, an increase in production may often be obtained by the proper selection of speeds and feeds. The selection of proper speeds and feeds seems to be a simple procedure, but it is not always easy to decide which is best to use because of the numerous variables involved. Some authorities have considered as many as twelve, but it would not be illogical to assume that there are many more than even that number. Basically, speed and feed selection depends upon three principal factors, namely: Workpiece; Tool, and Machine. As far as the workpiece is concerned, it is necessary to consider the wide variety of available materials, all the way from high temperature alloys down to magnesium. In addition, cutting performance is affected by the dimensions of the work, its rigidity, clamping conditions, and so on.

With regard to the tool, it is necessary to consider the various grades and types of cemented carbides and high speed steels. The effect of rake and clearance angles, the inclination of the cutting edge, the relative position of tool and work, such as "above center" or impact angle in milling, must be taken into account. The shape of the cutting edge, tool nose radius, and the method of cutting such as turning, drilling, broaching, milling, grinding and tapping likewise contributes to the difficulties involved. With regard to the machine-tool, it is necessary to consider the number and values of RPMs and feeds that are available, the horsepower at the cutting edge, the rigidity of the machines, their freedom from vibration, gear strength, thermal expansion, deflection and similar factors. Furthermore, these factors must be correlated to the concepts of tool life, cutting force, chip cross-sectional area, cutting speed, and so on.

The complexities pertaining to the selection of proper speeds and feeds were, to a great extent, responsible for many of the discrepencies in machine shop practice which were uncovered during World War II. At that time, it was the author's duty and privilege

— under an assignment as a Consultant to the Secretary of War —to travel all over the United States and to consult with contractors on the practical application of sintered carbide tools in the machining of artillery ammunition. Many visits were made and such topics discussed as speeds, feeds, tool angles, brazing methods, tool design, and so on.

A wide variance in production was encountered even within the same plant. As an example: On a "favorable" day it was possible to cut 98 shells to length with one tool before grinding, while on a "black" day only 7 shells could be so machined before the tool failed. Another example disclosed that a ratio of 1:7½ existed between the lowest and highest tool consumption on the same job.

Such differences were partly due to differences in the skill of the operators and supervisors. They often lacked sufficient information about tool life, speeds, feeds, and so on. However, differences in the design of the machine tools were also responsible for the great variations in tool life. On one type of shell lathe, the tool position changed with the instantaneous diameter being machined, thus changing the rake angles of the tool with respect to the work, while this was not the case on another type of machine giving better tool life.

Tool design was likewise often found to be the cause for bad or good machinability. As an example: The tool life of lathe tools with zero back and zero side rake was only 4 shells of a certain caliber per grind. Production jumped to 9 shells and later to 18 shells when the back rake was made 2 deg. and side rake 6 deg. This was an improvement of more than 300 per cent.

Dr. Max Kronenberg

DR. KRONENBERG'S work in metal cutting research covers ways and means of converting research data into recommendations, tabulations, charts, and so on, which can readily be used by superintendents, time study departments, machine operators, designers and sales engineers.

After receiving his Doctor's degree from the Engineering College of the University of Berlin, Dr. Kronenberg had a distinguished career in both industry and science. He is the author of over 120 papers presented before engineering societies and published in ten countries. For 12 years he was associated with the research department of the Cincinnati Milling Machine Co. and during World War II was consultant to the Secretary of War.

It is evident from the foregoing examples that the findings of metal cutting research have not found their way to a sufficient extent to the men who are supposed to use them. What is needed are ways and means to "get the message through" whereby the findings must be adapted to the background of the user of research data.

It is possible to present metal cutting research data in different ways—either in the form of charts, or in the

form of tabulations or as mathematical formulas or as instruction sheets. Charts have the advantage of providing a survey over the problems involved and permit the judging of the effect of changes in one quantity on another quantity. It is easier by means of charts to determine all values, while tabulations permit only certain data to be picked out.

On the other hand, tabulations are more useful when it is necessary to duplicate a reading every time once a value is determined. Charts, or diagrams, are usually not accurate enough to permit the reading of exactly the same value every time.

Management requires a different type of presentation of research results than the time study department, or the sales engineer, or the designer or the superintendent or the operator. A layman concerned with a machining problem—like a judge in a federal court or a lawyer in a patent case—is likewise often required to draw practical conclusions from metal cutting research and is therefore in need of a different method of presentation.

There are also differences in the coverage of results from metal cutting research. As an example we can cover:

a. One material, one machine and several tools, or
b. One material, several machines and several tools, or
c. Several materials, several machines and several tools.

Several examples shall now be discussed in detail.

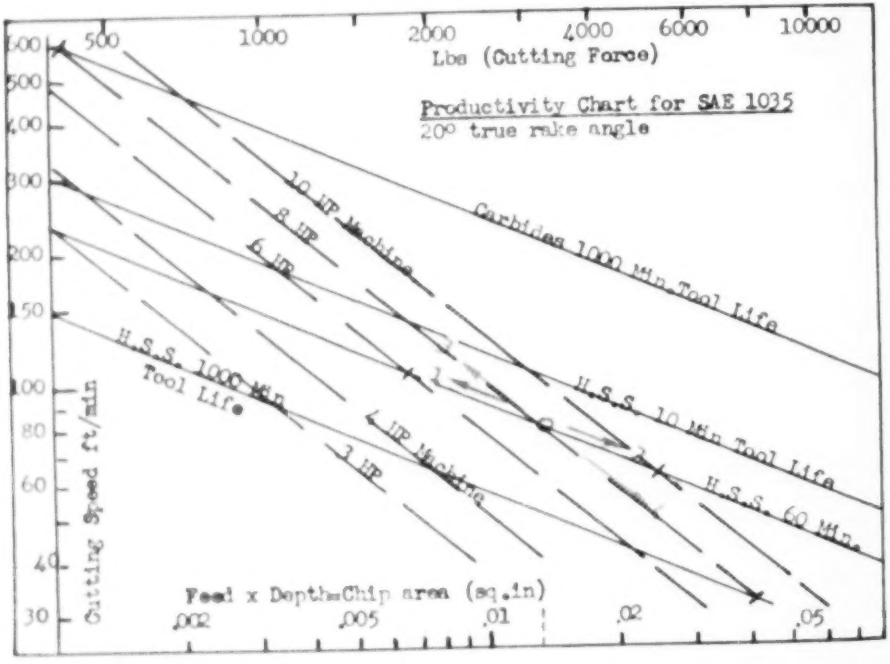

Figure 1—A productivity chart such as the one shown herewith provides a means for conveying basic conclusions of research to the tool engineer.

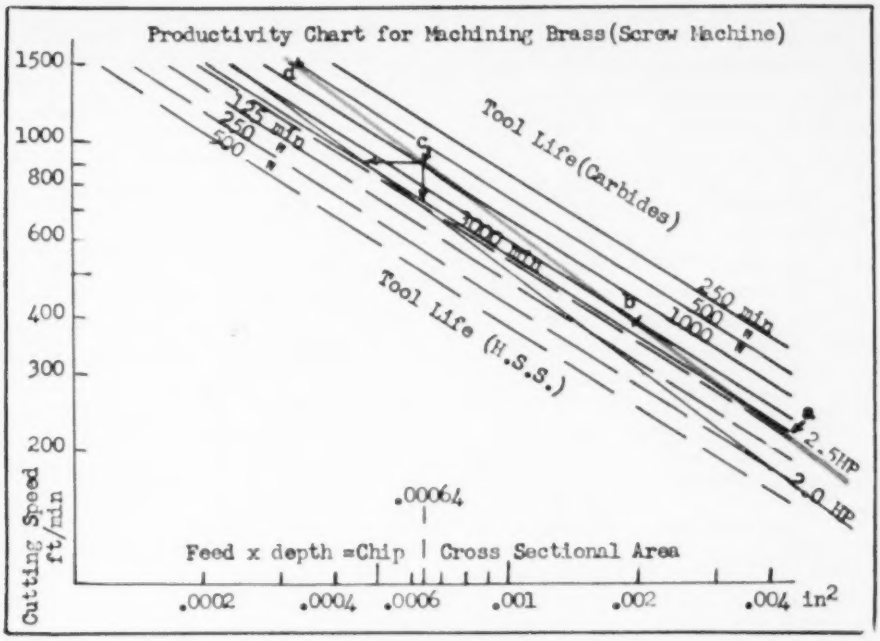

Figure 2—A productivity chart for the machining of brass.

General Productivity Chart

For a general survey of the relationships involved in the practical application of metal cutting research, a "Productivity Chart" as shown in Fig. 1, is very useful. This type of chart permits basic conclusions from research to be conveyed to the tool engineers usually not engaged in research. The very important fact will be seen from the productivity chart illustrated, that two different relationships exist between cutting speed and chip area (which is the product of feed by depth of cut). Basic relationships which govern machining processes can be derived from this fact. The productivity chart is as basic in the field of machining as the iron carbon diagram is in the field of production of steel and iron.

On the horizontal axis the product of feed by depth of cut (chip area) for values between 0.002 sq. in. to 0.050 sq. in. have been plotted The cutting speed is plotted on the vertical axis for the range from 30 to 600 ft. per minute. At the top of the chart a scale may be noted which indicates the cutting force from 500 to 10,000 pounds. The cutting force is useful for determining deflection data and for ascertaining whether the machine or the workpiece is rigid enough in connection with a desired accuracy. In the center field of the chart two series of lines are shown descending from left to right at different slopes. The lines with the lesser slope (Red) are the result of tool life investigations, while those with the greater slope (Green) represent horsepower and are the re-

sult of cutting force investigations.

These two series of sloped lines can also be considered to represent the two main concepts of machinability, one of which is based on tool life and the other one on cutting resistance. Since it is evident that the two series do not coincide, it can readily be seen that we cannot come to an agreement as to the concept of machinability by accepting both relationships for the definition. In the author's opinion, cutting resistance is the better criterion because it is more closely related to the work material and its properties than tool life. The latter is more affected by tool design than cutting resistance is affected by tool design.

Use of Productivity Chart

For the purpose of exploring the use of the productivity chart assume that a machine is rated at 8 HP capacity and that a high speed steel tool is used with a desired tool life of 60 minutes when removing a chip of 0.013 sq. in. (= ¼ in. depth by 0.050 feed). It may be observed from the red dot at the intersection of 8 HP line with 60 min. tool life line that these conditions can be satisfied when the cutting speed is set to 80 ft. per minute. It is now desired to investigate the changes in productivity that occur if speed, or feed or HP or tool life are changed.

Following the 60 min. tool life line in direction of Red Arrow 1, indicates an increase in cutting speed and a reduction in feed. In this manner, however, we approach the 6 HP line. Hence an 8 HP machine cannot be fully utilized if the feed is reduced and the speed increased while keeping the tool life constant. Metal removal would be reduced as can be seen from the following data:

at the Red Point "0":
0.0013 x 80 x 12 =
12½ cu. in. per min. metal removal
at the Red Point "1":
.0065 x 105 x 12 =
8.2 cu. in. per min. metal removal

which is a loss of 35 per cent.

Following the same 60 minute tool life line in the opposite direction, namely along Red Arrow 2 results in an increase in feed and a decrease in speed. Here the 10 HP line is approached, indicating that an 8 HP machine would be overloaded, which is not a practical proposition for any length of time.

A third possibility of changing speed and feed is indicated by Green Arrow 3, that is, by tracing along the 8 HP line. We increase again the speed (as in the first example, but even more so) and reduce the feed. In this case we leave the 60 minute tool life line and approach the 10 minute line. Since such a short tool life would be undesirable, we change from high speed steel to cemented carbide and thereby increase tool life to more than 1000 minutes. Metal removal is somewhat less than at the Red Dot, namely only 0.0065 x 144 x 12 = 11.2 cu. in. per minute. This is a loss of only 10 per cent as against the loss of 35 per cent when keeping the tool life constant.

In spite of this loss in metal removal which is always the result of feed reduction and speed increase, it is often desirable to reduce the feed and increase the speed according to the HP line. Here we get the green light, as indicated by Arrow 3. The loss is compensated by a gain in tool life, reduction in down time for changing tools, improvement in surface finish due to the disappearance of the built up edge, reduction of deflection of work and machine as indicated by the reduction

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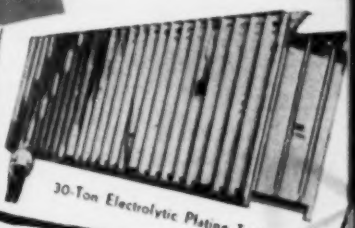

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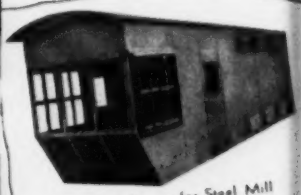

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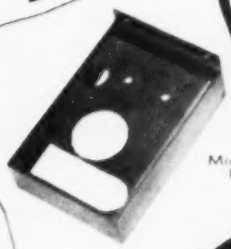

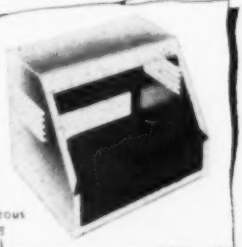

Miscellaneous Forming

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in cutting force, which drops from 3200 pounds at the Red Dot to 1800 pounds at Point 3. This type of varying speed and feed is recommended whenever the workpiece is unstable and/or when a high surface finish is desired. The wise improved in comparison with the Red Dot. The chip volume at 1000 min. tool life is 15.3 cu. in. per min. which is a gain of 22 per cent. However, the cutting force increases here considerably, namely from 3200 to 8000 pounds.

Time Study			
A. Job	Brass, 1" Diam. - 2½ HP Screw Machine.- Assumed feed = .0051 in/rev, Depth of Cut = .125 " } Chip cross sectional area = .00064		
Data from Productivity Chart	Problem	Answer	Conclusion
B.	Speed ?(for 2½HP and .00064 area) Tool Life ? Time ?	.....900 ft/min .....1000 min. ....3.42 sec per 1"	Tool Life not satisfactory
C.	3000 min Tool Life? (by feed reduction) Time ?	Reduced chip area = .00047 " feed = .0038" .....4.6 sec per 1"..... (34% increase vs.B)	Time not satisfactory
D.	3000 min Tool Life ? (by speed reduction) Time ?	Reduced speed = 740 ft/min .....4.15 sec per 1" (21% increase vs.B)	Approved in view of savings in down time, improved tool life and better time than in C. (200% increase in tool life)

Figure 3—A form sheet which may be used by the time study engineer as a supplement to the productivity chart.

changes should be made in accordance with the Green HP line and not in accordance with the Red tool life line. The tool should be adapted to the preselected speed whenever possible, and not the speed to the tool.

There remains still another possibility, indicated by Arrow 4. Here the feed is increased, the speed reduced and the HP is kept constant. Tool life of high speed steel is improved (we are approaching the 1000 min. tool life line) and the metal removal is like- The workpiece and the lathe would therefore be deflected considerably more than at the Red Dot, resulting in poorer finish and reduced accuracy. This type of change is therefore recommended only in the case of roughing heavy workpieces on powerful machines. High speed steel tools will often be satisfactory in such cases, as indicated by approaching the 1000 min. tool life line.

The preceding basic principles resulting from metal cutting research,

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shall now be applied to a time study example involving the machining of brass bar stock of 1 in. diameter on an automatic screw machine of 2½ HP and a depth of cut of ⅛ inch. Figure 2 represents a portion of the productivity chart for the machining of brass; it is the basis for a time study for determining the best combination of feed, speed, tool life and cutting time.

The cutting capacity of the machine being given (2½ HP), its line will be used to find the most suitable combination. The 2½ HP line is marked out in color for a better reading. Following this color line from left to right one obtains for each point on it a different combination of speed, feed, and so on. The cutting speed increases, while the chip area decreases. As an example we have in the chart shown here:

Point	Chip Area (sq. in.)	Speed (ft./min.)	Tool Life (min.)	Tool
a	0.004	225	60	HSS
b	0.002	375	2000	Cem. Carbide
c	0.00064	900	1000	Cem. Carbide

So far, the color line indicates that these combinations are admissible for machining brass on a 2½ HP machine. Which point, however, will be the most favorable in practice? Before proceeding to the answer of this question, attention is directed to point "c" and the two arrows shown there. One arrow is horizontal and located on the 900 ft. per min. speed line, the other one is vertical and located on the 0.00064 chip area line.

Figure 3 represents a form sheet which may be used by the time study engineer as a supplement to the productivity chart. In the top row, marked A, the main data are recorded, such as 1 in. diameter bar stock, automatic screw machine 2½ HP and so on. The time study engineer will usually assume a feed rate first, which he thinks would produce a satisfactory surface finish. Here we have assumed a feed of 0.0051 in. per rev. which is available on the machine. With a depth of cut of ⅛ in. the chip area is 0.00064 sq. in.

From the productivity chart, the time study engineer finds now that the speed for 0.00064 chip area is 900 ft. per min. (this is point "c" on Fig. 2). He finds, also, from Fig. 2 that the tool life would be 1000 minutes using carbides. The cutting time as calculated from these data is 3.42 sec. per one in. length. Conclusion: Due to the considerable down-time involved in changing tools on this automatic screw machine, the time study engineer comes to the conclusion, that 1000 min. tool life is not satisfactory and makes a corresponding note (Row B, Fig. 3). He wants 3000 min. and consults Fig. 2 again. There are at least two answers to the obtaining of 3000 min. tool life, as indicated by the two arrows at point "c" in Figure 2.

Following the horizontal arrow, on the 900 speed line, he finds that 3000 min. tool life can be obtained by reducing the chip area to 0.00047, which corresponds to a feed of 0.0038 in. per revolution. The cutting time, however, increases to 4.6 sec., which is an increase of 34 per cent. Conclusion: Cut-

ting time is not satisfactory. (Row C, Fig. 3)

Again consulting the chart, the time study engineer follows the vertical arrow of point "c"—on the 0.00064 area line. He finds that 3000 min. tool life can also be obtained by reducing the speed to 740 ft. per min. and adopts this value, because the cutting time is 4.15 sec. per inch, and therefore better than in the case of row C.

With a tool life increase of 200 per cent he approves therefore the following data: 740 cutting speed, 0.0051 feed, 3000 min. tool life, 4.15 sec. cutting time. (Row D, Fig. 3) It will be seen that productivity charts such as this one are a very effective means for applying metal cutting research to shop practice.

If it is desired to go into more detail as to the individual effect of feed and depth of cut, it is recommended to use charts like those which were prepared by the author in connection with the machining of artillery shells and which were published in the June 1941 issue of MECHANICAL ENGINEERING. In these charts, feed and depth of cut are read separately and are not combined into product (chip area) as in the charts presented in this article.

To be Continued

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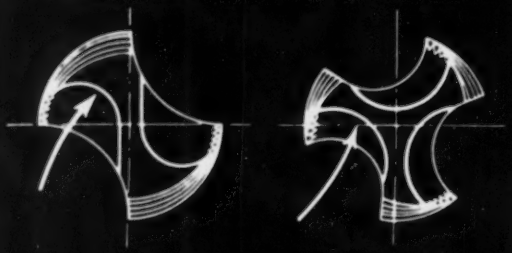

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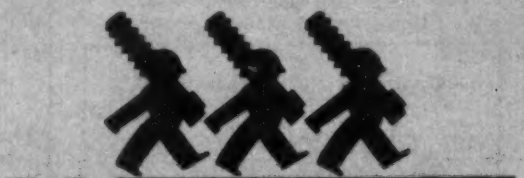

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Torque Testing Program Provides Helpful Data For Tap Design

By Bartlett West

A UNIQUE method of producing continuous records of the torque throughout thousands of tapping operations during a two-year tap torque testing program has given Greenfield Die and Tap Corporation complete and accurate histories of tapping cycles. These records are the basis for the design and production of taps, as well as recommendations for most efficient tapping operations.

In order to measure the twisting effort required while turning the tap, Greenfield engineers employ a vertical drive shaft incorporating a Baldwin SR-4 Torquemeter (right center in the accompanying illustration). This instrument, it is claimed, is completely independent of tapping operations, absorbing negligible power and thus permitting 99 per cent accuracy under shop operating conditions. Rapidly varying torque is recorded by a high speed ink-writing oscillograph (left) on a paper strip chart.

The Torquemeter is essentially a short length of shaft to which a group of special SR-4 resistance wire strain gages are bonded so as to form a Wheatstone bridge. The corners of the bridge are connected through slip rings on the shaft to station-

Equipment used to produce continuous records of tap torque during tapping operations.

ary brushes in the case and from thence to the recording oscillograph.

By means of this equipment it has been possible to determine the effects of such design variables as rake or hook, relief, chamfer, and other factors, as well as such operating conditions as speed, lubrication, rate of wear, and efficiency of tapping operations.

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The Jam Handy Organization has produced for the Delco Products Division of General Motors Corporation a 16 mm. black and white sound motion picture entitled "Motors on Parade," the purpose of which is to show the importance of the contribution of the electric motor to home, farm, transportation, and industry and also how electric motors are made on a mass production basis. The one-reel film, with running time of 26 minutes, is aimed primarily at equipment manufacturers, industrial motor buyers, and the replacement market. Secondary audiences include other business firms, school groups, foremen's groups, and civic and professional organizations.

Star of the film is Parker Fennelly, well-known for his role as Titus Moody in the Fred Allen radio show, "Allen's Alley," who narrates the Delco story while playing the role of the "Old Timer." There is no charge for the use of this film, which may be scheduled by writing to the Public Relations Dept., Delco Products Div., General Motors Corp., 329 E. First St., Dayton 1, Ohio. A folder describing the film in detail is available.

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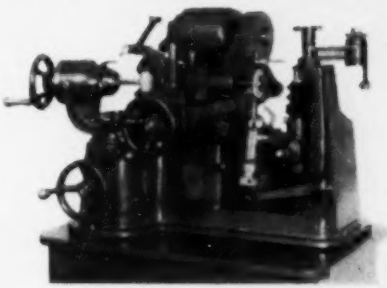

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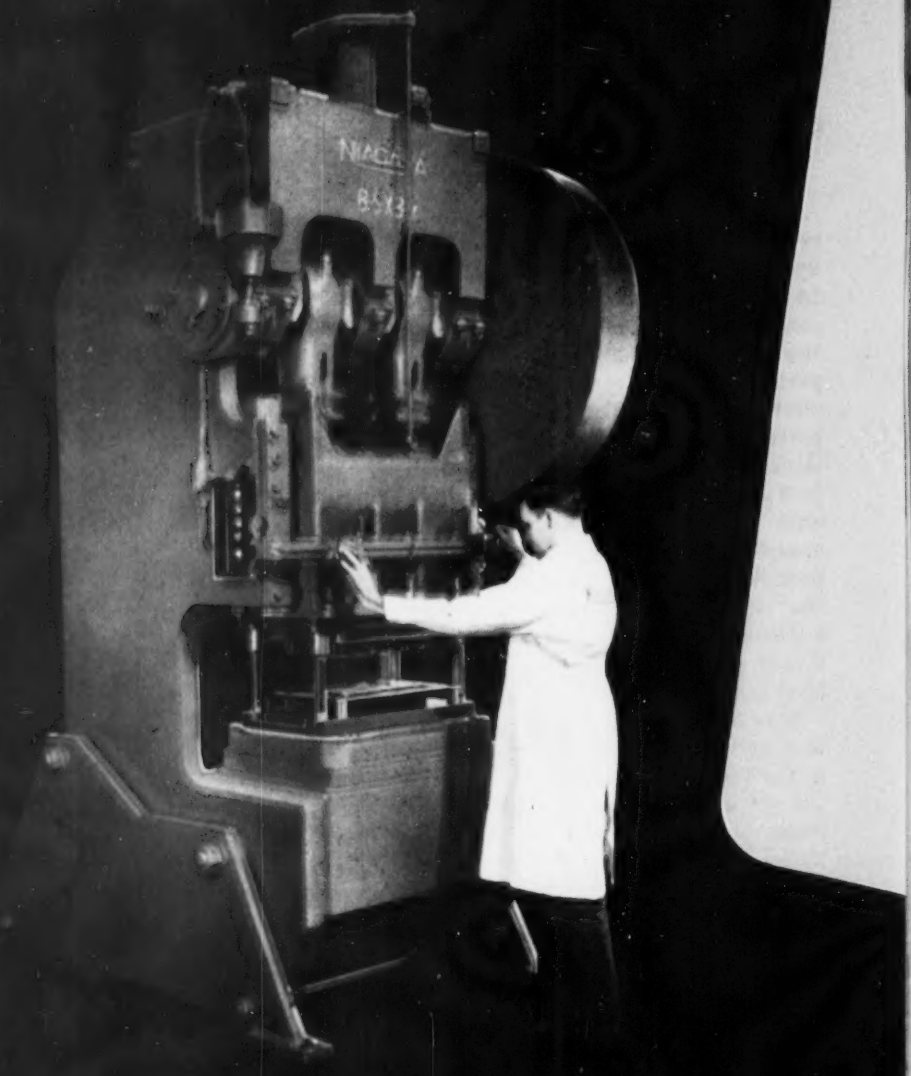

Niagara No. BE-4x30 Gap Frame Double Crank Inclinable Press fitted with magnetic perforating dies made by S. B. Whedler & Sons, Inc., Buffalo, N. Y. Press equipped with air actuated electrically controlled sleeve clutch.

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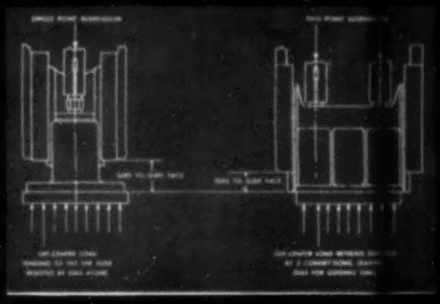

- Gives full support to wide dies, impossible to obtain on the conventional single point Inclinable Press even with slide flanged out.
- Gibbing may be brought closer to point of load application on this double crank press than with flanged slide single crank design.
- Two point suspension resists tendency of slide to tilt under off-center loading conditions.
- Niagara gap frame construction gives equal access to all four sides of die. No ribs or shafts extending across the back of press.
- Inclined position permits finished work to drop off the rear of the press.
- Gearing enclosed and running in oil.
- Backshaft mounted on anti-friction bearings.
- Air counterbalance for slide.
- Bronze bushed main and connection bearings.
- Niagara electrically controlled air actuated sleeve clutch.
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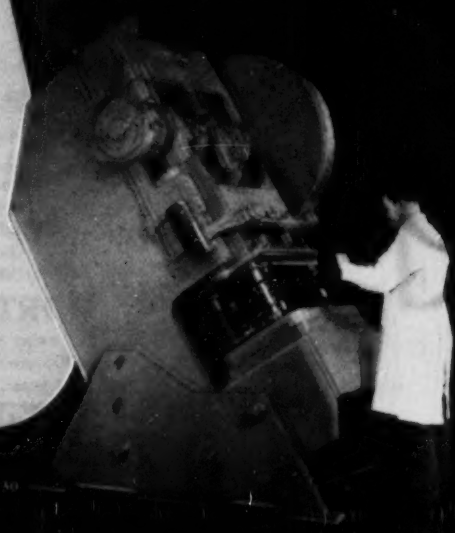

Illustration shows Niagara No. BI-5x30 press in inclined position.

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C. W. Hinman

Progressive Dies and Their Machines

Features and advantages of progressive dies and their use in both standard punch presses and special high speed machines are discussed.

By C. W. Hinman
Designing Engineer

WHILE progressive dies can be used on practically any suitable standard press, many of them are employed on special high speed machines to obtain more efficient die setups, as well as higher speeds with less down time. Since most of these dies are mounted in four-post die sets, it is practical, however, to use them on either a special machine or a standard punch press. The aim of this article is to discuss both cases.

Using Carbide Inserts

Figure 1 shows a longitudinal section of a 10-station progressive die in which two stations, Nos. 5 and 10, carry considerably more stress than any of the other eight stations. To minimize wear at these stations, carbide inserts are used, thus effecting a major savings in die replacements, together with greatly increased production. Figure 2 shows the type of carbide insert used at drawing station No. 5. This insert has been in use for more than a year and has performed over five million drawing operations without requiring maintenance.

Figure 3 shows the carbide cutting-out insert used at station No. 10 in the die shown in Fig. 1. This insert requires resharpening only once after making two million cuts. In the same manner, carbide inserts can be used in other progressive dies where wear is experienced at certain stations, thereby increasing economy of die operation.

The Universality of Progressive Dies

Progressive dies are capable of handling a work strip for consecutive operations on the surface of a die block, or for making deep draws up into dies located in the punch holder with a shedder encased to push out the shell. In either case, the work strip is left free to be moved along, after each operation, into stations ahead for a

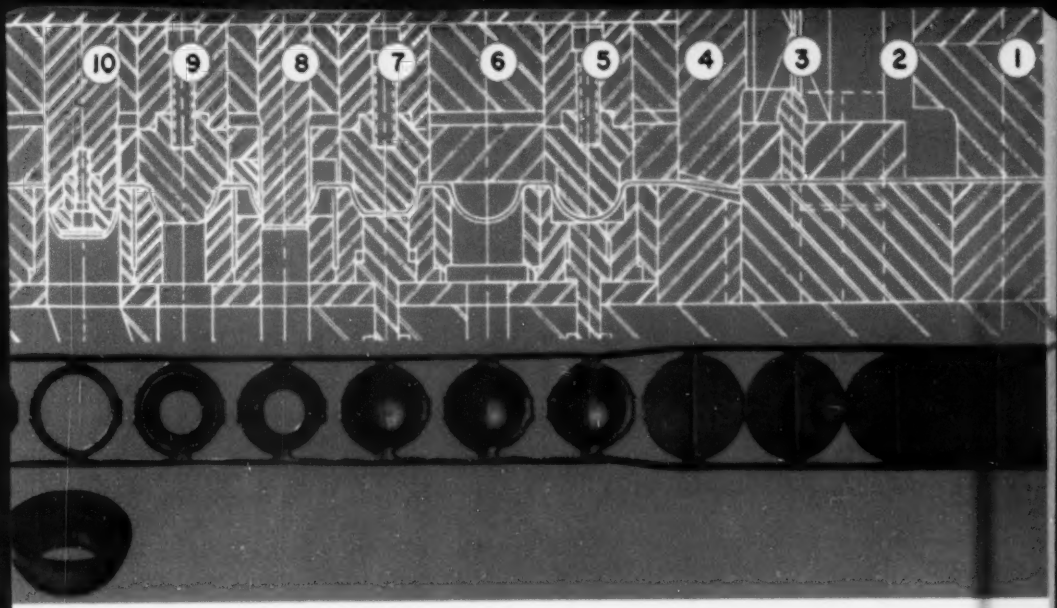

Fig. 1—Longitudinal section of a 10-station progressive die. Illustration courtesy Carboloy Co., Inc.

number of other operations. Progressive dies are limited only by the size of the work and its thickness. Work too large may be difficult to handle and work too thick may be difficult to pilot, straighten, or align from station to station. However, if these difficulties can be overcome, practically any piece produced in separate die operations in other dies can be manufactured on progressive dies.

Furthermore, progressive dies can be used to produce close tolerance work. Holes and the edges of work can be accurately located in millions of consecutive parts within tolerances of plus or minus 0.0002 inch or more. An example of such precision work is illustrated in Fig. 4. The work produced in this case is part of a crucible sheet steel escape lever used in large quantities in time fuses during World War II. Some 250 of these escape levers were produced per hour. It is obvious that to produce and maintain close tolerances, (1) the die must be built in sections and all interiors of the die contours must be ground to precise dimensions; (2) the blank would have to be cut in a high precision inverted compound die; (3) forming of the two side lugs would be more easily accomplished by forming them "up" instead of "down"; and (4) in the compound die used, the pierced slugs from the center hole would be delivered up into the punch and punch plate. This hole had to be at the center of gravity

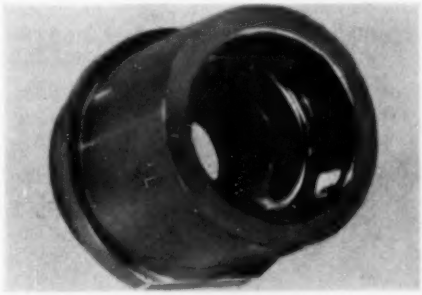

Fig. 2—Carbide insert used at drawing station No. 5 in die shown in Fig. 1. Illustration courtesy Carboloy Co., Inc.

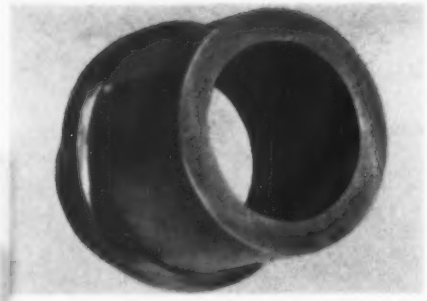

Fig. 3—Carbide cutting-out insert used at station No. 10 in die shown in Fig. 1. Illustration courtesy Carboloy Co., Inc.

of the part so that it would balance from the hole. This was one of the stipulations of the customer. The chute visible on the die section shown at the top of Fig. 4 is where the slugs are delivered from the inverted compound die.

In the shop where this die was designed and built, holes in the stripper plate and die blocks were lapped after grinding and then "bushed" for resistance to wear. Piercing and shaving punches were lapped to limits of plus 0.0001 and minus 0.0000 inch and were fitted in their respective places within 0.0001-inch clearances.

The die has 14 consecutive stations. The blanking center distance between stations worked out to 0.466 inch. Beginning at the right-hand end of the die, in the lower view, the operations performed at the stations are as follows: (1) pierce two pilot holes; (2) "pilot"; (3) idle; (4) idle; (5) idle; (6) compound blank and pierce; (7) idle; (8) idle; (9) idle; (10) trim around one side of blank; (11) idle; (12) trim around opposite side of blank; (13) idle; (14) form up two lugs, positive strip-off on punch, and eject finished work by compressed air.

The looped wire handle under the stripper plate at its right end is used to operate a finger stop for starting in a new strip. An automatic stop in the third die station aids the automatic roll feed used for advancing the strip into the die. At the lower right on the die shoe a snap gage is attached into which the strip must be cut and fitted before it enters the die.

The idle stations have their uses since the die is a sectional type and the sections are "sunk" into the die shoe in order to hold them in place, thus requiring a considerable amount of metal around all die openings. Another use for the idle stations is to provide shedder space for the compound die, since sufficient space is required for the

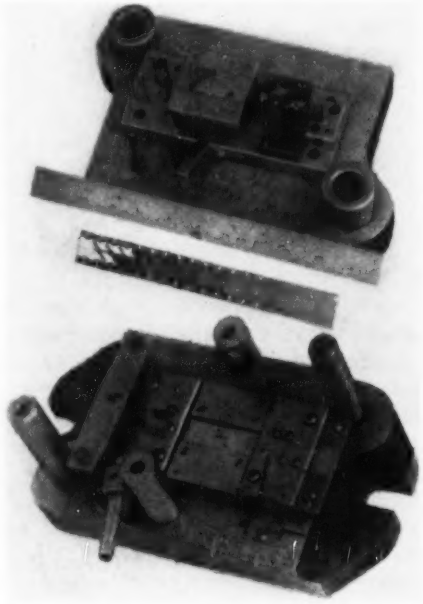

Fig. 4—Progressive die for producing close tolerance work. Illustration courtesy Moore Special Tool Co., Inc.

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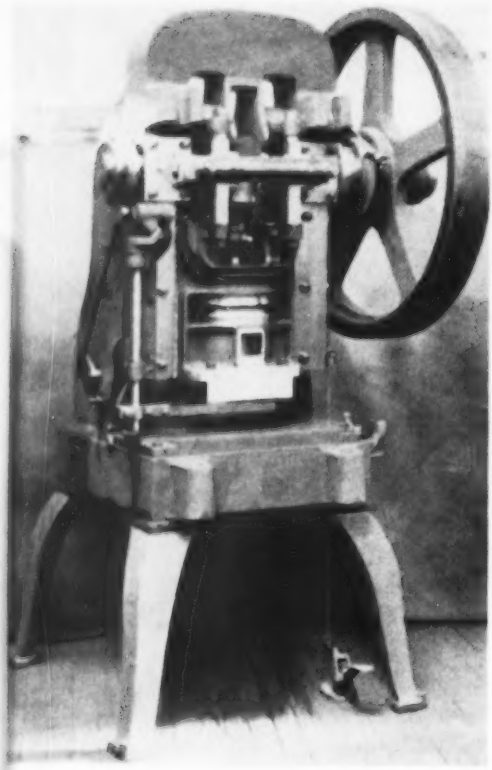

Fig. 5—Open gap high speed press for operating progressive dies. Illustration courtesy Waterbury Farrel Foundry & & Machine Co.

flange on the shedder and its necessary stripper bolts and compression springs.

In all progressive dies, and particularly the one just described, it is necessary to continually relocate the work strip with pilot punches that enter previously pierced holes in the marginal edge of the strip. The purpose of this operation is to register the work accurately at each of the work stations before the cutting punches contact the strip. In Fig. 4 it will be noticed that the pilot holes are pierced at the first station and that the scrap strip shows a continuous line of pilot holes near each edge of the strip. A spring plate located at the extreme left end of the die strips the work from the punch in ascent just before an air jet blows the finished work out of the die. The air connection is shown at the left end of the die.

The work strip is fed from right to left. The punches and dies are aligned by two substantial guide posts, and there are two shorter posts near the center of the die shoe that comprise the bumper pins. The purpose of the bumper pins is to check the punch

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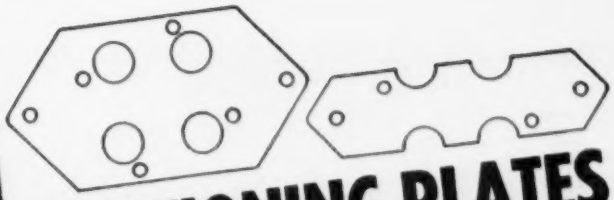

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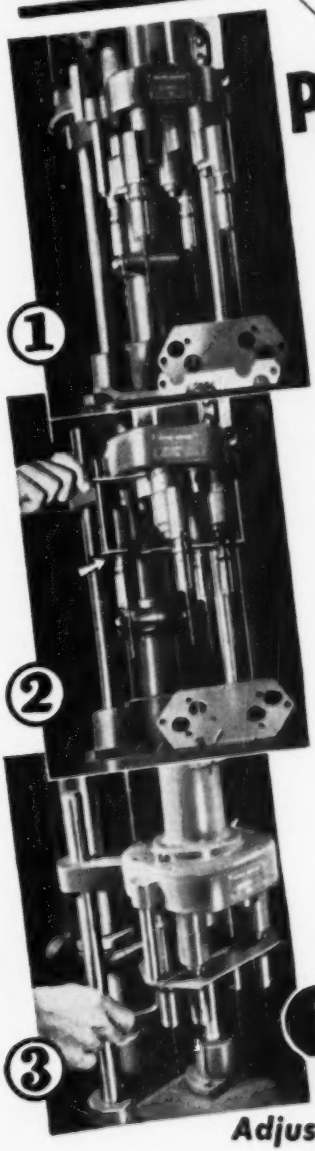

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2 **Mount the Half-Hole *Positioning Plates* on the support posts and swing the spindles into the positions indicated by the half-holes.**

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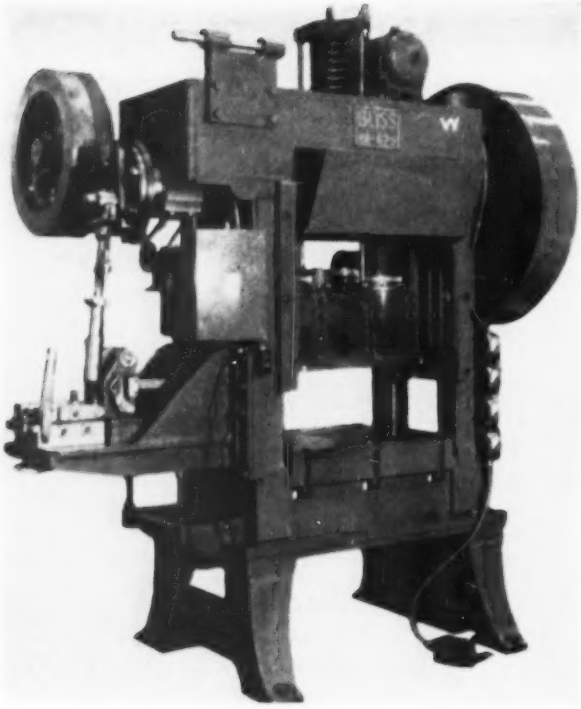

Fig. 6—High speed straight side press for handling progressive dies. Illustration courtesy E. W. Bliss Co.

holder descent so that at the completion of the downstroke, all faces of the punches and dies are at their proper working levels. Bumper pins also aid the die setter when setting up the die in a press, since they determine the closed height of the die at once, and thus avoid his making several trial cuts to determine the correct closed height. Another advantage of bumper pins is to compensate for loose action in the press ram which may be due to a worn press slide.

The die shown in Fig. 4 is designed to produce about 50,000 pieces per grind; however, sometimes more pieces than this number can be produced before regrinding becomes necessary. The strip is passed through the die by its contact between a pair of feeding rolls mounted in front of the receiving end of the die between the press and stock reel. This die has been operating on a 20-ton dieing machine which produces approximately 15,000 finished pieces per hour.

Figures 5, 6, and 7 are illustrations

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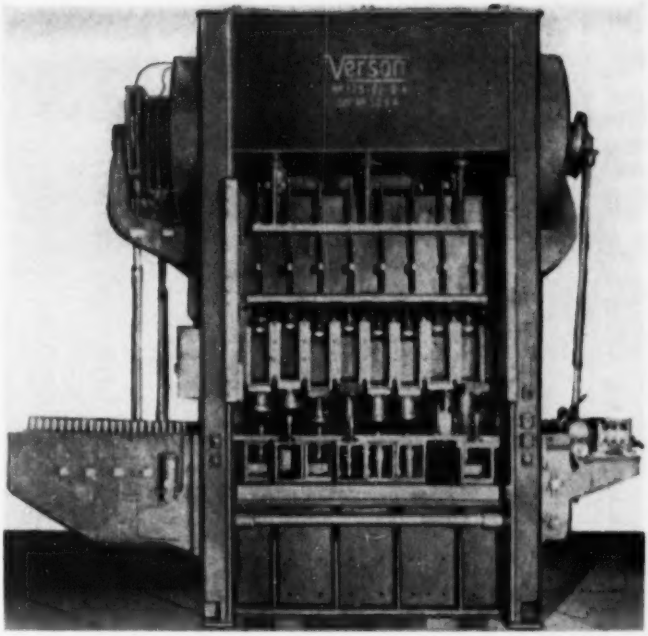
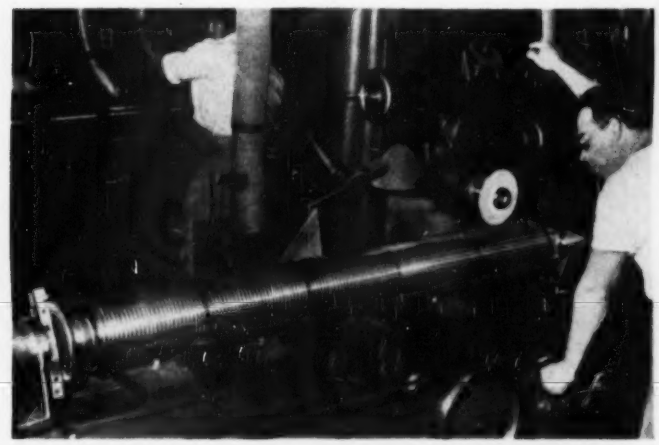
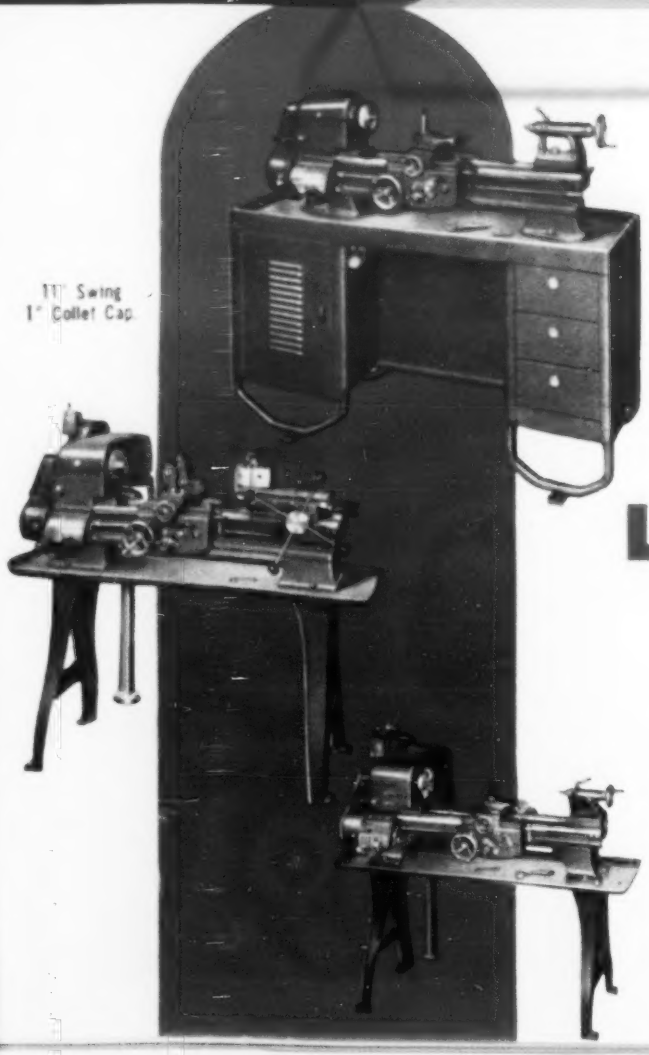


Fig. 7—Multiple operation transfer press in which coil stock is fed to blanking station and then transferred by finger feed for several succeeding operations. Illustration courtesy Verson All-steel Press Co., Inc.

of modern high speed presses used for operating progressive dies. Figure 5 shows an open gap frame high speed press; Fig. 6, a high speed straight side press; and Fig. 7, a multiple operation transfer press in which coil stock is fed to the blanking station and then transferred by a finger feed for several succeeding operations.

SHOWN here being finished at Colonial Tool Co., Ltd., Windsor, is what is believed to be the largest broach yet produced in Canada. Designed for broaching a 46-tooth internal gear in a single pass, the broach is 5 feet long and approximately 6⅞ inches in diameter. The part produced with the broach is used in a heavy duty automotive axle. The involute teeth are 1¾-inch face. Approximately ⅛-inch whole depth of tooth is removed in the single operation on the steel forging. Note the four steady rest positions ground into the one-inch piece broach for ease of resharpening when required.





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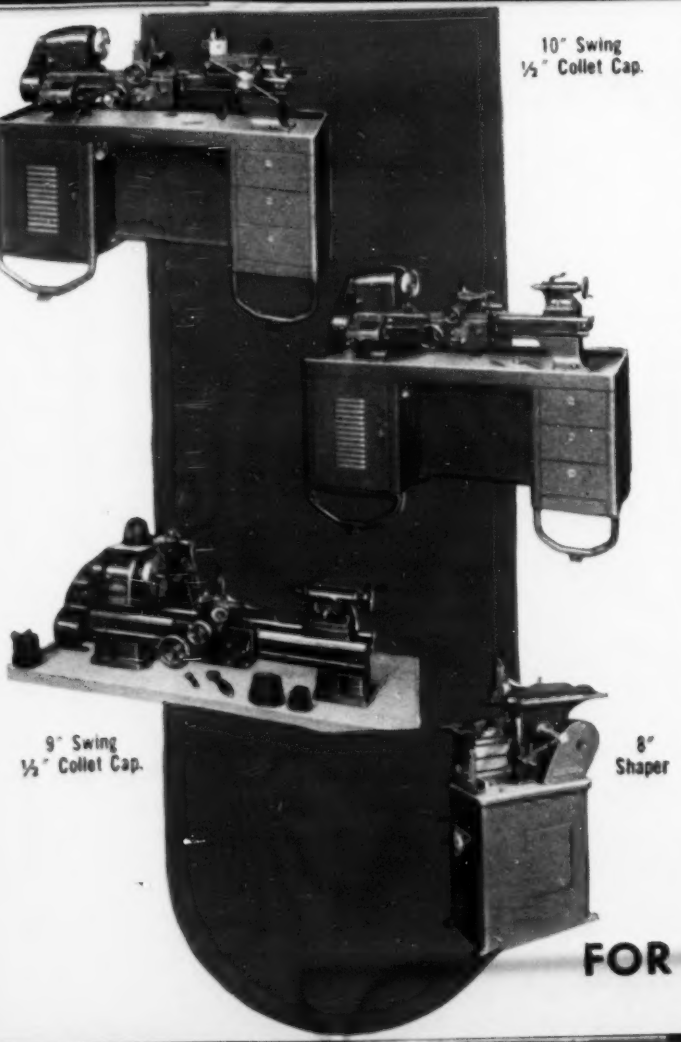

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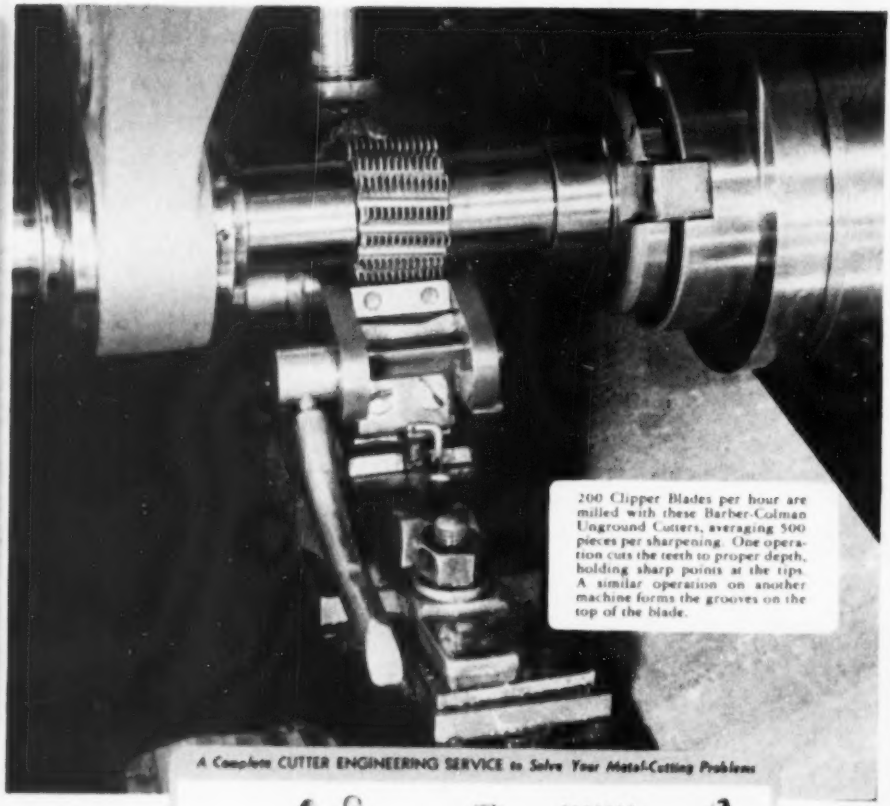

200 Clipper Blades per hour are milled with these Barber-Colman Unground Cutters, averaging 500 pieces per sharpening. One operation cuts the teeth to proper depth, holding sharp points at the tips. A similar operation on another machine forms the grooves on the top of the blade.

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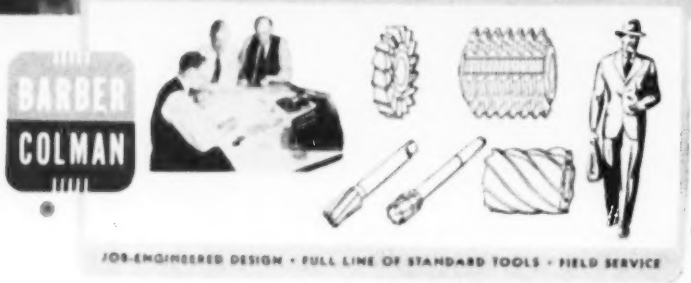

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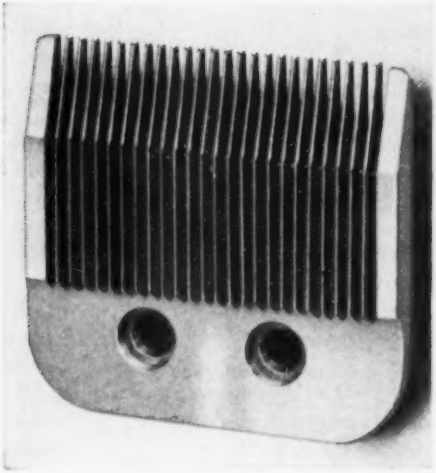
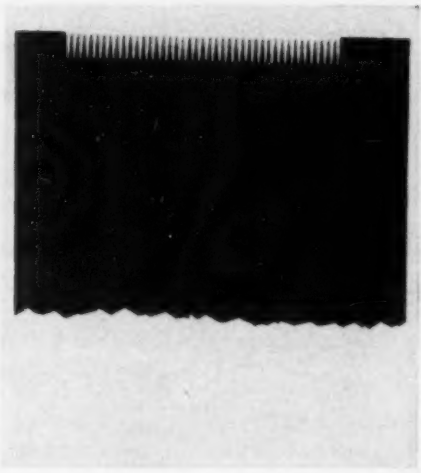


▲ Clipper blade showing depth of form, with teeth ranging from .012" to .018" thick depending on blade style. One operation cuts the teeth and a second forms the grooves on top of the blade. Other Barber-Colman cutters are also used to mill the angle, sides and back of the blade.



▲ Enlarged section of teeth indicates the cutter problems in milling long thin teeth with sharp tips. Cutters are designed with intermittent rows of teeth to give extra tooth strength and to assure uniformly sharp points. This design assures consistent accuracy and long life.

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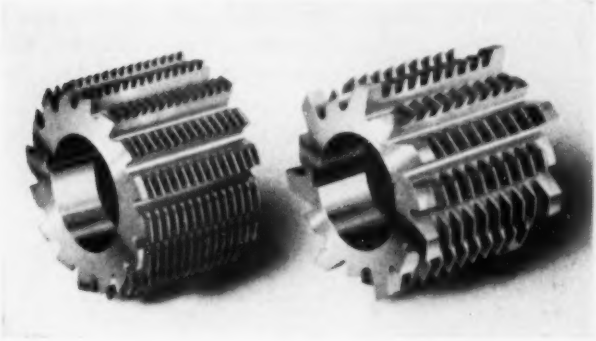
▼ Pitch of cutter teeth is held within .0005". Cutters are unground with straight or helical gashes. The pitch of one cutter must match the pitch of the other to assure absolute alignment of grooves with teeth on the blade. Barber-Colman design assures duplication of accuracy whether cutters are ordered in sets or individually at intervals.



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Practical Toolmaking, Part I

In which the author discusses the basic causes of tool failures, both before and after the tools are put in service.

By J. Y. Riedel

Tool Steel Engineer, Bethlehem Steel Co., Bethlehem, Pa.

GENERALLY speaking, a manufacturer of production tools is faced with two major problems. The first problem is to produce a tool which is hard enough to "stand up" under the anticipated service conditions and which at the same time, is ductile enough so that it does not crack either in manufacture or in use. The second problem is to produce a tool which will be of the proper size and shape after it has been hardened, without the necessity of excessive "finishing" of the hardened surfaces.

This article deals with investigations of typical tool steel failures. By analyzing tool steel failures, methods of avoiding similar failures can be developed. Thus, from a knowledge of "how not to make tools", we learn how to make tools properly. The types of tool steel under consideration in this article are the common tool steel grades which are used in large quantities and which are produced by practically every manufacturer of tool steel. Typical compositions of these

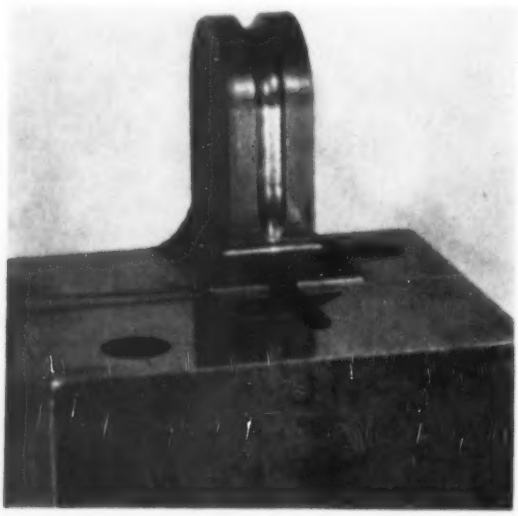

Fig. 1—Illustration showing die made of manganese oil hardening steel. Cracks in this die were very faint and are exaggerated by magnetic powder. Cracking occurred because of excessive quenching stress set up between the body and the small protruding section. The walls of the cracks were found to show a yellow temper color, indicating that the crack was open during the tempering operation and thus had begun in the quench. This tool should be made up as a two-piece assembly or an air hardening steel should be used if this design cannot be changed.

steels, classified by their common names rather than trade names, are shown in Table I.

The majority of failures of tool steel may be classified in the following groups, based upon initial observation of the point at which trouble is first encountered: (A) Failures due to design, (B) Failures due to forging or rolling defects in the steel, (C) Failures due to improper heat treatment, 1. Failure to harden properly in heat treatment, 2. Cracking in heat treatment, (D) Failures due to grinding checks, (E) Failures due to heat checks, (F) Failures due to rapid wear, (G) Failures due to premature breakage in service, and (H) Mechanical failures.

This method of classification may not be exact because, for example, failures due to premature breakage in service may actually be due to grinding checks, or tools which crack in heat treatment may do so because of faulty design. However, the true cause of a tool steel failure is not always known at the time the failure is first observed, and hence the most exact classification is not convenient to use. Each of the groups mentioned above will now be considered separately.

Fig. 2—This die made of manganese oil hardening steel cracked in the quench at unnecessarily sharp change of section. Cracks are exaggerated by magnetic powder. Tools of this type are most commonly made up as a two-piece assembly.

Failures Due to Design

Many tools which crack during heat treatment operations should be considered as failures of design since the heat treater is sometimes asked to treat tools which are impossible to heat treat properly. The most common design faults which cause cracking

TABLE I

Name	C	Mn	Si	Cr	W	V	Mo
Carbon Tool Steel	1.00	.25	—	—	—	—	—
Mn Oil Hardening	.90	1.20	—	.50	.50	.20	—
High-carbon high-chromium	1.55	.40	—	11.50	—	.40	.80
Air Hardening	1.00	.60	—	5.25	—	.30	1.10
Si-Mn Shock Resisting	.60	.70	1.85	—	—	.20	.45
W Shock Resisting	.50	.30	.75	1.20	2.50	.20	—
Cr Mo W Hot Work	.35	.35	1.00	5.25	1.50	—	1.65
W Hot Work	.35	.30	—	3.00	9.00	.30	—
18-4-1 High Speed	.72	.30	—	4.00	18.00	1.00	—
6 Mo—6 W High Speed	.82	.30	—	4.25	6.25	1.90	5.00

trouble in heat treatment are as follows: (1) Heavy sections adjacent to light sections, as shown in Fig. 1, and (2) Unnecessary sharp corners. Fillets should be provided wherever sharp corners are not actually needed, as shown in Fig. 2.

Some tool steel failures which occur in service should also be attributed to

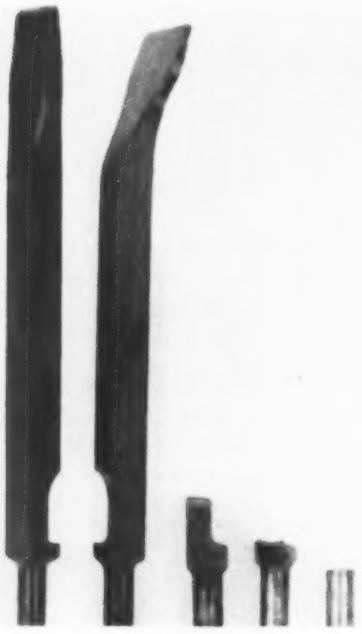

Fig. 3—Pneumatic chisels made of silicon-manganese shock resisting steel, showing fatigue failures at different changes of section.

faulty design. The most common design faults which cause service failures are: (1) Failure to fillet corners. In some applications, such as pneumatic tools, even a fillet is considered a design fault. On pneumatic tools, tapers should be used exclusively to change section size or shape, as illustrated in Figs. 3, 4, and 5. (2) Failure to provide proper tool clearances, and (3) Excessive concentration of load.

One way in which design can influence the performance of tools is in the design of auxiliary equipment. For example, it is a well known fact that the punching of holes of diameter less than the thickness of the material is difficult, if not impossible, due to punch breakage. However, if the punch is designed to work in a close fitting supporting bushing, it is often possible to punch holes which otherwise would have to be drilled.

As a further example of the effect of design upon the use of tools, consider the punching of hard steel such as railroad tie plates. If punches for an application such as this are allowed to go all the way through the plate, the punches wear rapidly and break when they lose clearance. To avoid this difficulty it has been found that if the punches are adjusted so that they go only about 4/5 of the way through the plate, the "button" will pop out. Since the punch does not go through the hole, the excessive wear and consequent breakage is avoided.

The effect of tool clearance upon performance is readily apparent in operations such as punching and blanking. Many punch and die sets are made up with a "standard" clearance. Since the proper clearance for punching soft steel is approximately 1/10th of the stock thickness, it is apparent that "standard" clearances are correct for only one stock thickness. Proper clearances result in minimum tool load and sharp, clean punchings. Improper clearances result in deformed punchings, which accompany excessive tool loads.

In spite of the extreme care used in the manufacture and inspection of tool

Fig. 4—Pneumatic chisels showing most widely used design (below) and improved design (above). Even with the generous fillets shown, the chisel shown below is subject to fatigue failure at the section changes. No shank failures have been observed on chisels of the improved, tapered shank design.

steel, occasionally steel containing defects is encountered. Usually these defects are of such a type that they are readily recognizable as material defects. The most common defects are: (1) Voids. These may be porous areas classified as "pipe" or may be large cavities due to "bursting" in rolling or forging, (2) "Streaks". These are defects which are usually longitudinally located with respect to the original bar stock. They may be due to segregation, porous areas, entrapment of non-metallic materials such as slag, or mechanical defects such as laps on the surface.

Due to the random occurrence of material defects, they rarely show any relation to machined tool contours. Over a period of years, the investigation of thousands of failed tools has shown that material defects account for only a few percent of the tool failures.

In contrast to material defects, which account for only a few percent of all tool failures, improper heat treatment accounts for approximately 80 per cent of tool failures.

The failure of tools to harden in heat treatment is a subject which needs only brief attention since most heat treaters are familiar with correction of this type of trouble. Unsatisfactory hardening of tools is most likely to be due to: (1) Failure to heat to a high enough temperature, (2) Failure to quench at a fast enough rate, (3) Decarburization of the surface metal, leading to soft skin, and (4) Retention of austenite as a result of heating to an excessively high temperature.

Failures of tools by cracking in hardening, or shortly after hardening,

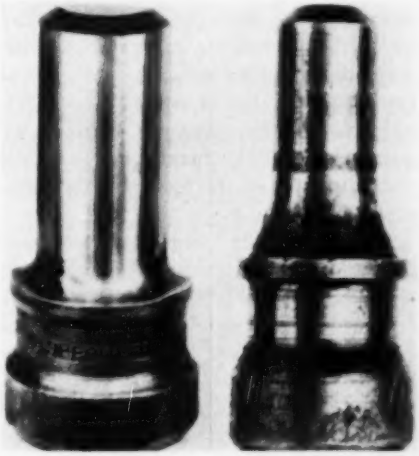

Fig. 5—(Left) Showing most commonly used design of rivet set. In spite of the well-rounded fillet at the change of section, failures occur frequently at this location. (Right) Showing improved taper shank design of a rivet set. No shank failures have ever been observed on rivet sets of this design. (Note failure in body which occurred through heavy tool marks. Tool marks such as this constitute surface defects which cannot be tolerated on a pneumatic tool. These tool marks should have been removed by grinding.)

are the most difficult to analyze and the most difficult to explain with any degree of satisfaction to the owner of the cracked tools. The basic heat treatment operations necessary to harden any of the standard types of tool steel involve simply heating the steel to a

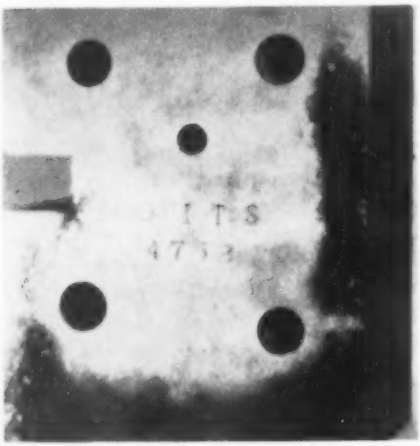

Fig. 6—This die made of manganese oil hardening steel cracked in sharp corner because of quenching too cold or failure to temper immediately after quenching.

sufficiently high temperature, followed by cooling at a rate fast enough to develop the desired hardness. The quenching operation is practically always followed by a tempering operation, the function of which is to partially relieve the stresses induced by quenching, while sacrificing a minimum amount of the hardness developed by the quench.

The foregoing summary of heat treatment operations may make this sound like a very simple procedure. However, the heat treatment of tool steel is a subject which can not be given enough attention. Basically, avoiding the cracking of tool steels in heat treatment can be accomplished by carefully following the specific instructions given by almost every tool steel manufacturer. If these instructions are followed, there should be little difficulty in the heat treatment of tool steel. However, there exists a certain amount of confusion about some of the procedure involved in heat treating and the following recommendations are offered concerning the individual operations carried out in connection with the heat treatment of tool steels.

Stress Relief—Wherever very accurate tool work is being done, it is often desirable to employ a stress relief operation before the hardening operation. Stress relieving is an important operation, particularly on tools which have been highly stressed in the production of the tool, such as by heavy machine cuts, hobbing, forming, etc. A stress relief may prevent the cracking of tools which could result from the addition of the residual stress in the tool to the thermal stress produced in heating. However, it is important to realize that after stress relief it is necessary to re-measure the tools and correct any dimensions which have been changed as a result of the stress relief operation. If this is not done, excessive distortion will likely be found in the hardened tool. (The stress relief has no effect whatsoever on the avoidance of excessive distortion in the hardening operation.)

Preheating—Reference to practically every publication on tool steel will show that careful preheating is recommended as a preliminary operation in heating nearly all types of steel. A preheat operation is in most cases just insurance; it may not be beneficial but it cannot be detrimental. It will be found that in the majority of small

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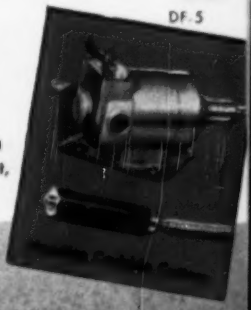
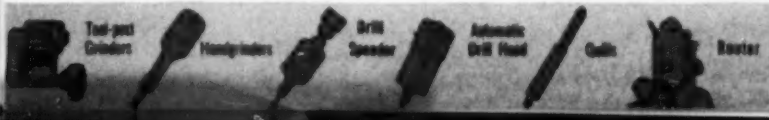




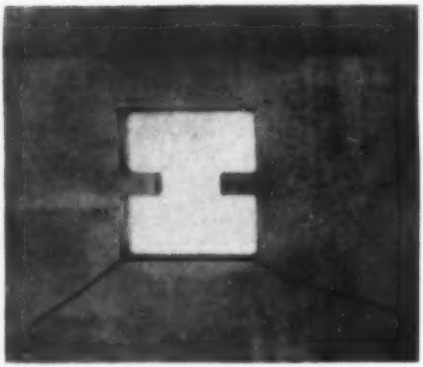
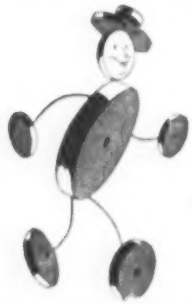


Fig. 7—This die made of air hardening steel cracked through sharp corners because the die was never tempered. Cracks are exaggerated by magnetic powder.

tools, where no appreciable amount of cold work (such as would occur from stamping, punching, shearing, hubbing, or hogging in machining) has been done, a preheat operation is not actually necessary (if quenching temperature is below 1600 deg. F) and no disastrous results would be expected from the elimination of the preheat. However, if a tool has been appreciably cold worked or if it is not in a fully annealed condition, a preheat operation is recommended as a precaution against cracking of the tool during heating.

Large sections or tools with heavy sections adjacent to light sections should be preheated to avoid excessive temperature gradients which can cause warping or cracking.

Wherever quenching temperatures are 1600 deg. F. or higher it is usually found advantageous to preheat tools. This is because a preheat makes it easier to heat a tool uniformly at the



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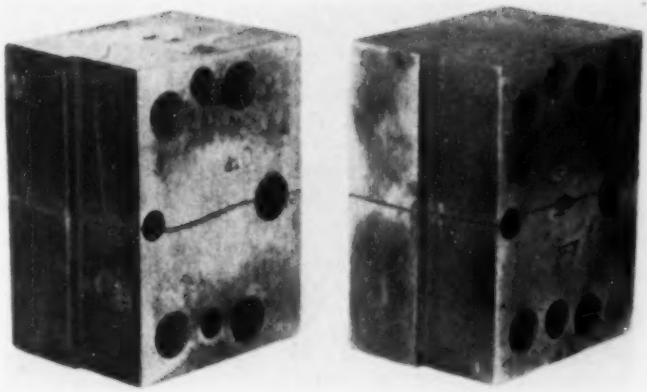

Fig. 8—These dies made of maganese oil hardening steel cracked because of failure to temper immediately after the quench, even though no drastic section changes are present.

quenching temperature. Where quenching temperatures are high, it is necessary to use the shortest possible time at high temperature in order to keep scaling and decarburization to a minimum. Preheating facilitates this.

Quenching — All liquid-quenched tools should be quenched to between 150 and 200 deg. F. Air hardening steels should be cooled to 150 deg. F. These temperatures can be estimated by the "feel" and "spit" tests. All tools should be tempered immediately after quenching. ("Feel" test—this test consists of determining the temperature at which a tool can be uncomfortably picked up by hand without getting burned,—approximately between 140 and 150 deg. F. "Spit" test—temperature above or below 212 deg. F. can be detected by applying a moistened finger to the tool; sizzling indicates a temperature over 212 deg. F.). However, a more scientific and exact method of measuring 150 deg. F. or 200 deg. F. is to use "Tempil-sticks" (chalk sticks designed to melt at specific temperatures), or contact pyrometers.

Tempering—The tempering operation is one on which it is penny-wise and pound-foolish to attempt to save time. Tools in the as-quenched condition often have internal stresses which may closely approach the ultimate strength of the material. It is the function of the tempering operation to reduce internal stresses to a point where the tool can perform its intended function without cracking for fracturing. It has been found by experience that, unless adequate time is allowed for

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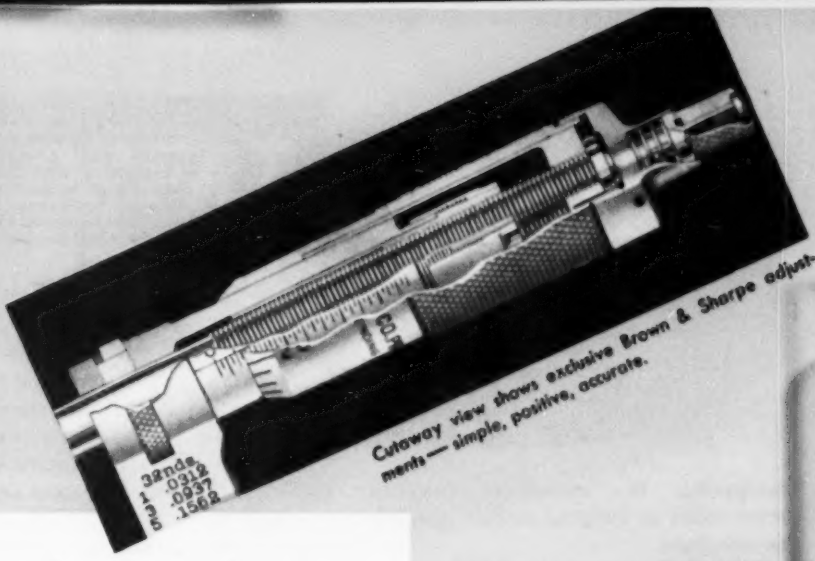

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Fig. 9—This drawing die made of maganese oil hardening steel cracked by quenching from an excessively high temperature, even though the design is simple and no sharp section changes occur.

tempering, the maximum benefits from relief of internal stresses cannot be obtained.

For tempering tool steel at approximately 400 deg. F., it is recommended that a minimum time of 2 hours per inch of minimum cross-section be used. Whenever the tempering temperature is low, as for example 300 deg. F., the tempering time should be doubled (4 hrs. per inch). In the higher temperature ranges, (for example, 1000 to 1200 deg. F.), as often used on stock-resisting tools, it is less important to temper for an extended period since stress relief occurs more rapidly the higher the temperature; in this instance, tempering for ¾ to 1 hour per inch of section is adequate.

Double Tempering—Some types of tool steel such as high speed or hot

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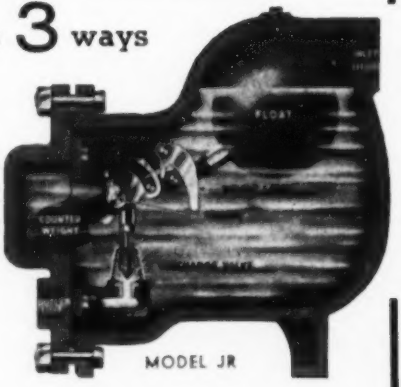

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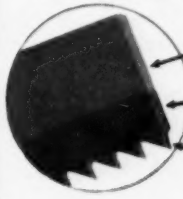
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Fig. 10 — This roll made of carbon tool steel cracked during heat treatment because of non-uniform chill.

work steels require double tempering to put them in the best condition for service. This is due to the fact that these steels retain austenite as-quenched. The first temper affects the martensite formed in the quench and "conditions" the austenite so that it transforms to martensite upon cooling from the temper. A second temper is necessary to affect the newly formed martensite. The omission of a second temper on hot work steels may lead to early failure by heat checking. On high speed and high-carbon high-chromium steels, the omission of a second temper may result in abnormal sensitivity to grinding checks.

Martempering—Some heat treaters prefer to harden the oil hardening

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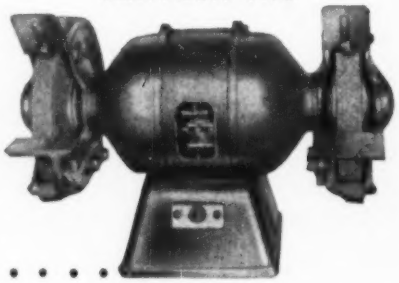

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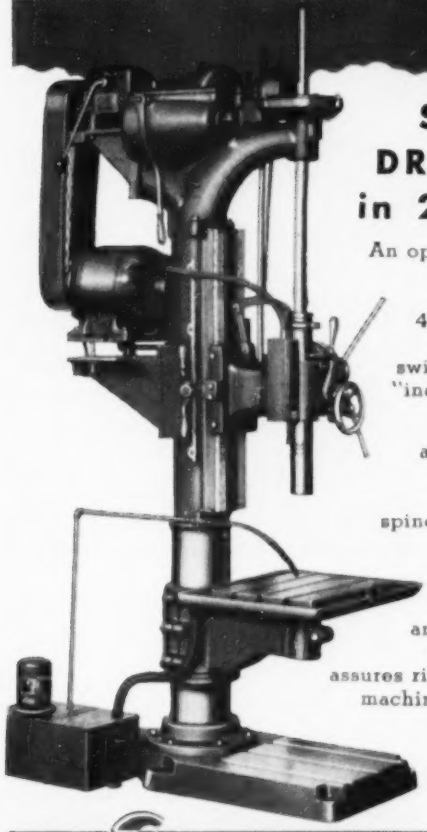

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grades of tool steels by martempering. Martempering consists of quenching in a molten salt bath which is maintained at a temperature slightly above the temperature where martensite begins to form and holding the tool in this bath until its temperature is uniformly at the bath temperature; next,

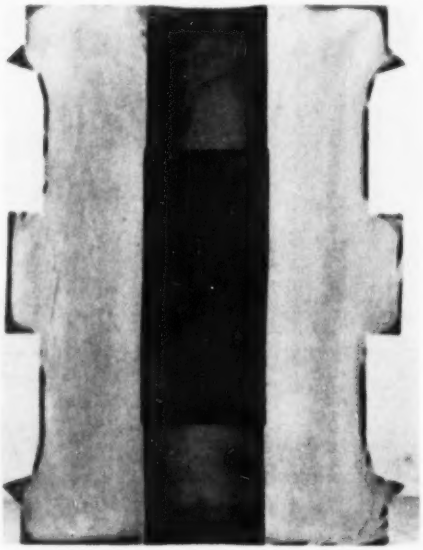

Fig. 11—Illustration showing an etched section of roll shown in Fig. 10. Dark areas indicate the hardened chill which is exceptionally non-uniform.

the work is removed from the bath and allowed to air cool. The customary tempering operation then follows. In this method, the hardening occurs more or less uniformly throughout the section during air cooling. Thus, the warpage resulting from a drastic liquid quench is avoided. However, martempering has no effect whatsoever upon the expansion which normally occurs when martensite is formed during hardening of tool steel, regardless of the method of hardening.

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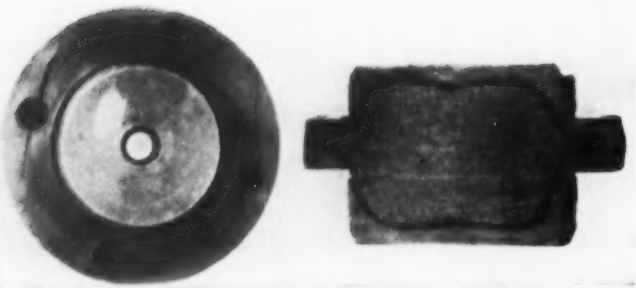

Fig. 12 — (Left) This die made of carbon tool steel cracked in hardening because of the fact that the rim hardened all the way through. (Right) Etched section through the roll showing hardened chill and soft core.

There are also instances on record where improper martempering has aggravated cracking troubles rather than eliminated them.* It is recommended that martempering should only be used for hardening under very rigid metallurgical control or where the repetitive nature of the work allows the development of a practical heat treatment procedure. Successful martempering requires the utmost in accuracy of temperature controls and indicators. Large sections which cannot be adequately cooled in 10 minutes in salt should not be martempered. Generally the hardness obtained after martempering is slightly lower (½ to 1 point Rockwell) than would be obtained by oil quenching.

Some heat treaters have commented that the foregoing instructions sound

* "The Interrupted Quench and Its Practical Aspects," by H. E. Boyer, A.S.M. Transactions, Vol. 38, 1946, p. 209.

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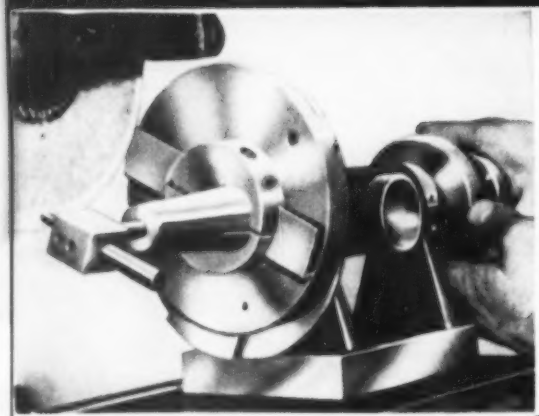

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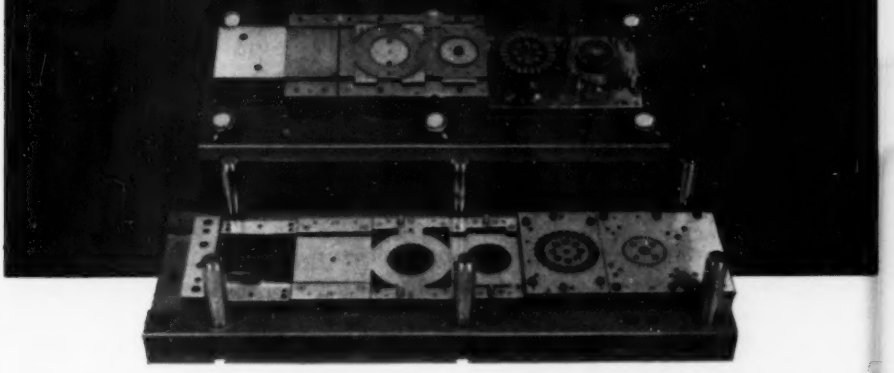

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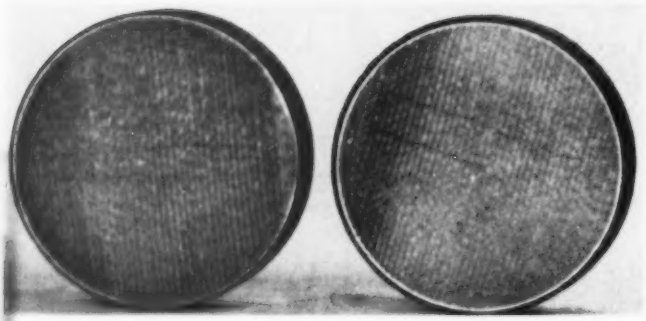
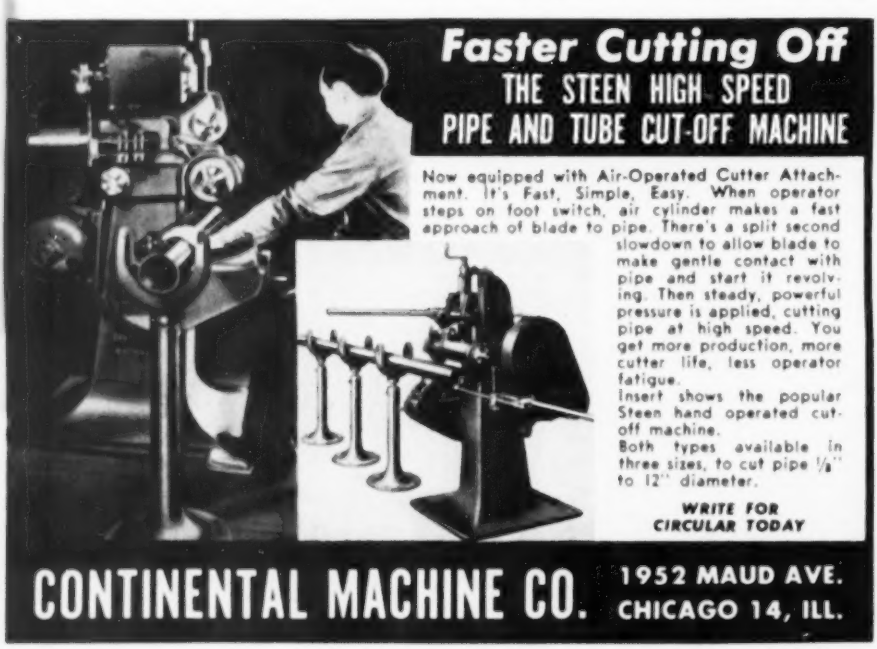


Fig. 13 — Illustration showing light grinding cracks in end of punches made of high-carbon high chromium steel. Not etched. Note the parallel cracks which lie at 90 degrees from the direction of grinding

like "kid-glove" handling of steel, and that if the steel were any good it wouldn't need such careful handling. Experience has shown that a large percentage, possibly 90 per cent, of tools can be successfully heat treated without following all these instructions. To avoid cracking the remaining 10 per cent of tools, however, requires careful quenching to the correct temperature followed by immediate and effective tempering. Improper handling at this point in the heat treatment procedure is the most frequent cause of cracking of tools in heat treatment, as illustrated in Figs. 6, 7, and 8. There are countless instances on record where a number of identical tools made up from the same stock were processed and heat treated together, and a few tools in the group cracked while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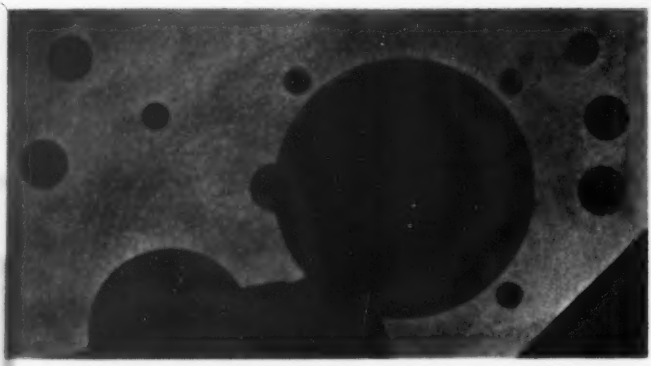

Fig. 14 — Illustration showing heavy grinding cracks in a die made of maganese oil hardening steel. This die failed in service by enlargment of the grinding cracks. The grinding cracks were not visible on the die surface until the die was magnetic powder tested. The die was cold etched to make the cracks visible for photographing. Note the characteristic network pattern of the cracks.

the majority of the tools were satisfactory. Investigation of tools which crack under these circumstances rarely produces any useful information; to prevent this type of cracking careful adherence to the procedure previously discussed is required. The heat treater who quenches tools one day and tempers them the next day can expect a certain amount of cracked tools.

The second most frequent cause of cracking of tools in heat treatment is quenching from too high a temperature, as illustrated in Fig. 9. It is important to quench from the temperature range recommended by the manufacturer of the steel. Equally important is the fact that pyrometer equipment which accurately indicates the temperature of the tools is necessary.

Water hardening carbon tool steel normally hardens (in sections larger than 1 in.) with a case and a core. This shallow hardening characteristic may cause two other types of cracking not encountered in oil or air hardening tool steels: (1) Large sections of water hardening carbon tool steel (larger than 4 in.) are particularly sensitive to cracking in heat treatment if the quenching operation does not produce a consistent and uniform chill on the tool. Soft spots on the surface may cause cracking in the quench tank, after removal from the quench, or even in the tempering furnace. Cracking of this type may be violent enough to be classed as an explosion. (See Figs. 10 and 11). Soft spots may be caused by, (a) Use of fresh water containing dissolved air, (b) Use of contaminated water, (c) Insufficient quality of

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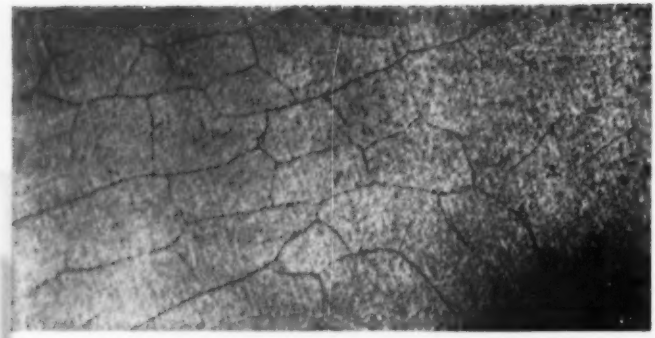

Fig. 15 — Illustration showing grinding cracks in a ring die made of carbon tool steel. Severely cracked in grinding because of sensitivity introduced by an excessively high quenching temperature. Die was cold etched to exaggerate the cracks. Note both parallel and network type cracks. (Enlarged 3X)

quenching solution, or (d) Inadequate agitation in the quench. A drastic brine quench which produces a uniform chill is the cure for this type of difficulty; (2) Tools made of carbon tool steel which have a section which will harden all the way through adjacent to one which does not harden all the way through are very sensitive to cracking in treatment. Either the tool should be redesigned or an oil or air hardening tool steel should be used to avoid this difficulty. (See Fig. 12).

The tendency of tools to crack in hardening is greatly affected by the type of steel being used. Water hardening carbon tool steel and manganese oil hardening tool steel are most like-

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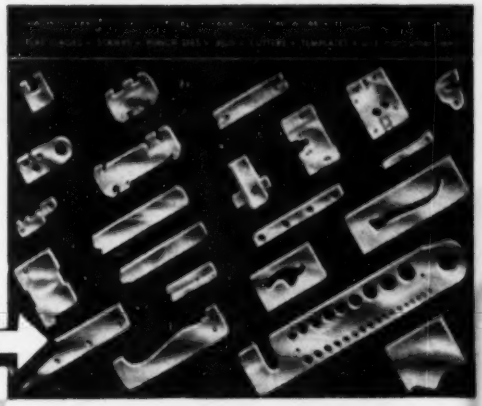

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ly to crack if they are not handled properly. Air hardening tool steels give practically no trouble due to cracking in hardening, which is the main reason for their increasing popularity. If it were not for the relatively poor machinability of air hardening tool steels, they would be more widely used than they are today.

Fig. 16—Punch tip made of chromium-molybdenum-tungsten hot work steel. Crack pattern is typical of heat checking developed on most hot work tools.

Failures Due to Grinding Checks

The grinding of a hardened tool is an operation which is usually not given much attention or thought—until trouble develops. It is obvious from the nature of the grinding operation that intense localized heating occurs during grinding. As a result, very high surface stresses may be set up. In a highly stressed hardened tool this may cause cracks, as illustrated in Figs. 13

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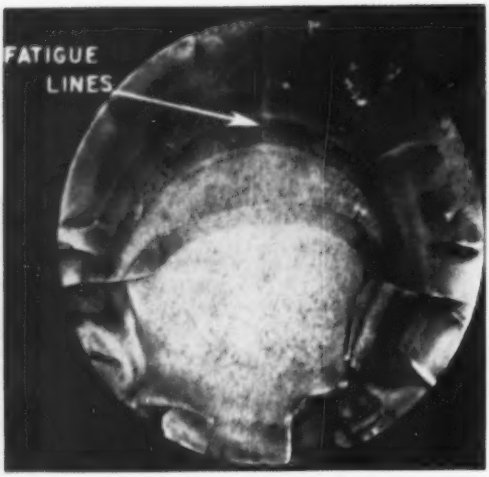

Fig. 17—Shaft made of silicon-manganese shock resisting steel. Shows characteristic fatigue failure at a change in section.

and 14. By improper grinding, it is possible to crack almost any properly hardened tool by (a) Scorching, which is associated with too rapid removal of metal, or (b) Grinding with a dull, loaded wheel, or (c) Grinding with a wheel of too fine grit size for the job at hand, or (d) Ineffective use of coolant fluid.

On the other hand, if a grinder is asked to grind a tool which has not been adequately tempered, or has been embrittled by an excessively high quenching temperature, it is not logical to hold him responsible for cracks which develop in grinding. (See Fig. 15). In instances such as this, the very best in grinding technique may not be adequate to prevent grinding cracks and the cure must obviously be effected prior to the grinding operation.

High-carbon high-chromium die steels are the most difficult types of steel to grind. However, if reasonable precautions are taken to use a clean, coarse grit wheel with moderate removal of metal and adequate use of cooling fluid, this grade can be ground without difficulty.

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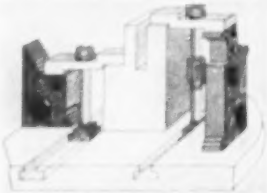

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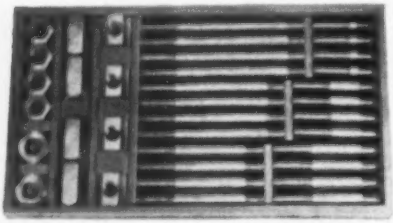

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Failures Due to Heat Checks

Heat check failures of tool steels occur largely on hot work steels. Heat checks develop as a result of repeated alternate heating and cooling operations. Ultimately, all steels used in hot work operations will fail by heat checking if they do not fail first in some other manner. (See Fig. 16).

Some hot work steels will fail rapidly by heat checking if they are water flush cooled between operations. Generally speaking, hot work steels with large amounts of tungsten and molybdenum fall in this category. Since the tungsten and molybdenum bearing steels have the highest red hardness, it is necessary that they be used on some hot work operations. In order to avoid excessive heating of the tools made of these grades, it is customary to provide duplicate tools, which are used alternately. The lower alloyed hot work steels containing only small amounts of tungsten and molybdenum will usually withstand flush cooling.

Occasionally tools other than those used on hot work operations will fail by heat checking. One instance on record involved rotary slitter knives made of high-carbon high-chromium tool steel. Upon investigation of the conditions under which the slitters operated, it was found that the knives were adjusted with no clearance so that the two slitters rubbed on each other. This action resulted in generation of sufficient heat to cause heat checks. Proper adjustment of the knives eliminated this trouble.

Failures Due to Rapid Wear

When tools fail by unusually rapid wear, the difficulty can often be attributed to inadequate heat treatment operations—either decarburized sur-

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Fig. 18—Open spike die made of hot work steel and deformed spike. Improper feeding of stock caused overloading and breakage of the die.

faces or low hardness resulting from improper hardening.

Inadequate wear resistance may also result from the use of the wrong type of tool steel. If a blanking die is made of a 0.60 per cent carbon shock resisting steel, it cannot be expected that the wear resistance will be as good as if a 1.50 per cent carbon high-carbon high-chromium steel is used.

Failures Due to Premature Breakage in Service

Upon investigation it is found that failures due to premature breakage are almost entirely due to one of the other types of failures previously outlined; Premature breakage may be due to: (A) Poor design which overloads some portion of the tool, or (B) Cracks resulting from improper heat treatment or grinding which were not noticed before the tool was placed in service.

Premature breakage can result from the use of the wrong tool steel grade. For example, the use of a 1.50 per cent carbon high-carbon high-chromium steel for a chipping chisel in place of a lower carbon shock resisting grade would lead to premature breakage.

Premature breakage may also result from other unexpected sources. For example, examination was made of some thread chasers which had shown thread breakage early in service. It was found that the tools had decarburized teeth which were not hard enough to cut properly. They deformed in service and ultimately broke out.

Premature breakage may also result from the use of tools at hardness levels above that which has been found pro-

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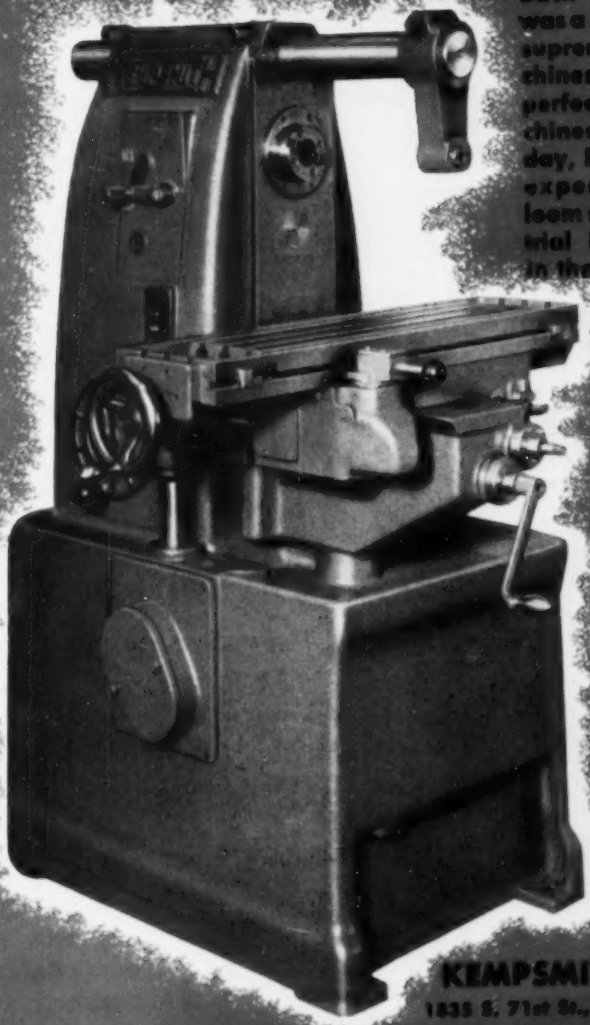

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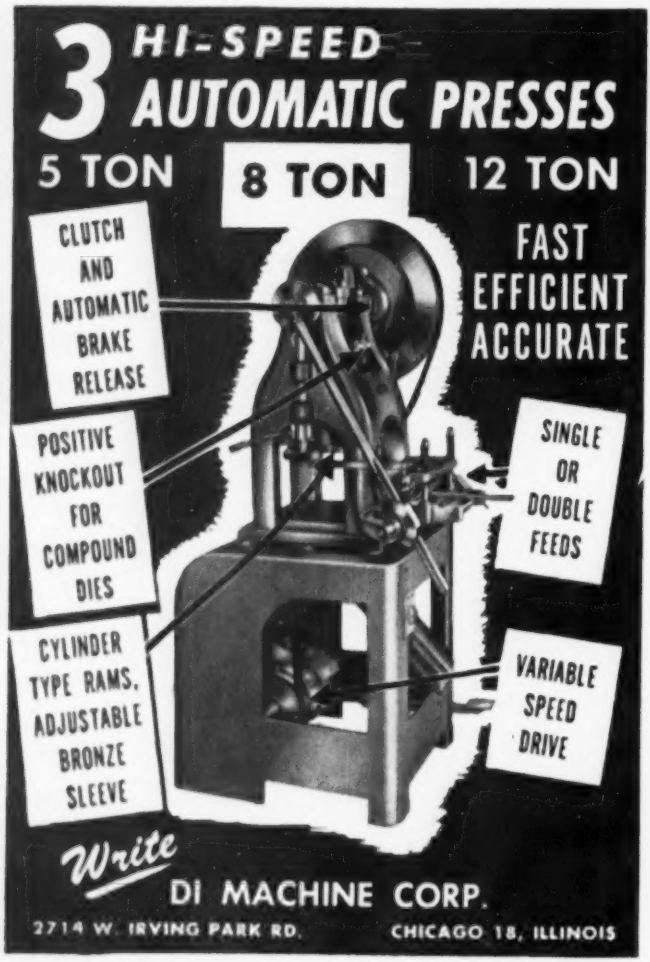
per for the particular job at hand. For example, most shock resisting steels are used in a hardness range of Rockwell C55 to 60, averaging about C58. If an attempt is made to get better wear resistance by specifying C62, premature breakage of tools is likely to occur.

Another type of failure which may be classed as premature breakage is known as fatigue failure. A fatigue failure is progressive in nature in that a small crack forms first; then the crack progresses part way through the section; finally the remaining section breaks suddenly due to the excessive concentration of load. Fatigue fractures always have a characteristic appearance, showing a smooth rubbed surface where the initial crack was open and an inner crystalline zone revealed by the final sudden break. Often the smooth, rubbed surface will show parallel "oyster shell markings" and may even show evidence of rusting. (See Fig. 17). Most fatigue failures are due to poor design or improper machining or finishing. They occur most often at sharp, unfilleted corners and are aggravated by tool marks, stamping, and so on. Elimination of fatigue failures requires elimination of "stress raisers" of any nature.

Ineffectively quenched tools (usually with low hardness) may fail prematurely by fatigue and decarburized surfaces produced in treatment which are not removed will cause premature fatigue failure.



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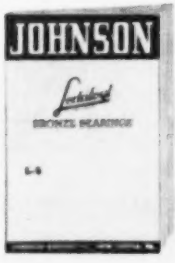

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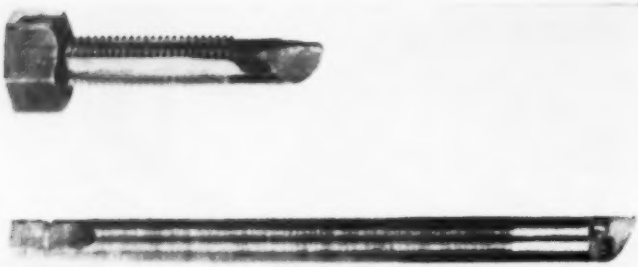

Fig. 19—Nut tap made of 18-4-1 high speed steel. Failure occurred as the tap entered the nut because the nut was too hard (514 BHN) to be machinable. By accident, the heat treated nut had not been tempered after quenching.

Mechanical Failures

Mechanical failures of tool steel can result from a variety of causes, such as, (A) Improper alignment, (B) Improper clearances, (C) Overloading by design, (D) Overloading by accident, such as two multiples going into a forming or blanking die. (See Figs. 18 and 19). (E) Overloading as a result of using tools with dull edges.

In order to learn the most from tool steel failures they must be analyzed fully to determine the basic cause of failure. It is not proper to automatically place the blame on the operation where the trouble is encountered. Realizing that many tool makers do not have the facilities for laboratory investigation of tool failures, a series of simple tests which will be of help in analyzing tool steel failures is described herewith.

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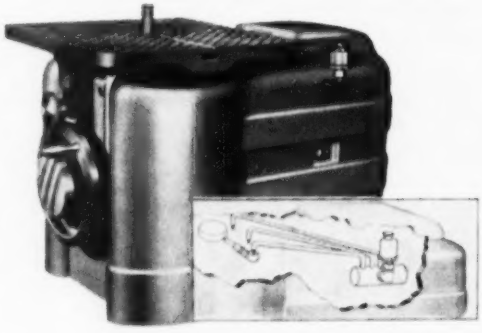

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   The examination of fractures of failed tools can also be informative. If temper colors are visible on the fracture it is certain that the crack was open during the tempering operation. If characteristic fatigue lines are visible, they point to failure under actual service stresses. A coarse fracture may indicate overheating during the hardening operation.
3. Hardness test—the usefulness of this test is obvious. If hardness testing equipment is not available a file test in the hands of an experienced man can supply valuable information.
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Quality Control Pays Off In Assembly Operations

Presenting helpful data, including easy-to-understand charts and graphs, for use in controlling rejects in assembled products.

By C. W. Kennedy

IN THE course of assembling indicators and gages, each instrument is carefully and individually calibrated for accuracy. Then, as a final step in the assembly routine, each instrument is justified with its shipping order for model, type, quantity, and the like, in direct preparation for packing and shipping.

While both the calibration and packing slip verification are full fledged production operations, they take on an inspection tinge because, in addition, each assembly is given a general inspection. At either of these two production stations, any of the indicators or gages may be rejected and sent back for adjustment, rebuilding or other work because it fails to meet rigid standards in accuracy, operation and appearance.

At these two points, quality control techniques in the form of per cent defective charts and so-called "c" charts might well be put into effect. To establish and maintain the charts, quasi-inspection operations supply information daily on a simple report form like that shown in Fig. 1. Such a report shows how many instruments are assembled daily by each operator and the total production. It also not only reports the total number of indicators rejected but also points to the assembly operators responsible for the faulty mechanisms. And, in addition, a count or daily analysis is kept of the reasons or causes for rejection.

A word should be injected here concerning the classifications of cause for rejection. Left to his or her own devices, an inspector might well think up innumerable terms describing the causes of trouble. A list of fifty or more reasons, considerably reflecting his personal terminology, would not be hard to conceive, and even then an inspector could think up still more special shadings of descriptions of defectiveness. For the sake of simplicity and order, as closer examination of Fig. 1 reveals, the inspector is expected to confine the enumeration of defects within seven general classes.

Inspection reports usually receive scant attention after a few days in the average shop, probably because they supply too much detail. Their effective-

Fig. 1 — Illustration showing arrangement of simple report form

DAILY FINAL INDICATOR INSPECTION

DATE 9-5

Quantity Inspected					TOTAL
A	B	C	D	E	
F	G	H	I	J	506

Quantity Rejected					
A	B 1	C 11	D	E 11	
F 1	G 1111	H	I 1	J 11	13

Bezels & Crystals	7
Hands & Pinions	3
Dials	1
Backs	4
Operation	5
Specifications	
Miscellaneous	

c Count 20 Per Cent Defective 2.5%

ness is diluted by many ingredients. The comparison might be made reading a list of city populations and trying only in that way to appreciate of what this country is made. As your eye travels from Akron to Hartford to Omaha to Portland, your interest wanes. Mere figures jade the attention. You might be a little surprised at Houston's hugeness or Helena's smallness, for instance, but the rest of them tend to lump together.

A way of making inspection reports come alive to production, engineering and management is not only to condense them, simplify them, but to emphasize the highs and lows on charts. At the end of a day, as Fig. 1 shows, the tallies on the report are totalled and from these the percentage of total production returned as rejected is written in as well as the so-called "c" counts of defects or causes of rejections. Daily per cent defectives are plotted on a chart such as shown in Fig. 2 and the rejection causes appear on "c" charts like those shown in subsequent figures.

Anything more than a cursory glance at Fig. 2 reveals the ups and downs of assembly quality results for a certain month in which, for a couple of days, 6 per cent of the crop had to be returned and something like 4 per cent on other days. As a general thing, rejections oscillated between 1 and 3 per cent.

So much for what the chart dramatizes in comparison to an ordinary tabulated monthly report. But it offers another and perhaps more important leverage on assembly quality. It brings

into play the practical use of a quality control technique which might be described as the philosophy of normal variations.

This philosophy tells us basically that duplication is unusual if not impossible; that some degree of variation in the number of daily rejections should be expected and need not be fretted over. In fact, if exactly the same number of assemblies were rejected day after day, suspicion should be aroused that the records were being "fixed" or that something artificial or counterfeit was occurring, for it is very unlikely that a group of humans could produce either no rejections or the same number of rejects more than two days in succession.

On the other hand, while variations are to be expected, they should nevertheless stay within certain normal bounds. If the output of an assembly group is unusually good one day and decidedly inferior another, it is a natural sign something needs investigating. Unavoidable variations in any process have certain characteristics which distinguish them from those avoidable variables **foreign** to the process. One of the functions of statistical quality control is to analyze these differences.

Such an analysis is immediately performed by so-called control lines. In Fig. 2 these appear as horizontal, parallel, dotted lines. They mark the band — the "certain normal bounds" just mentioned above — within which normal variations may and should occcur.

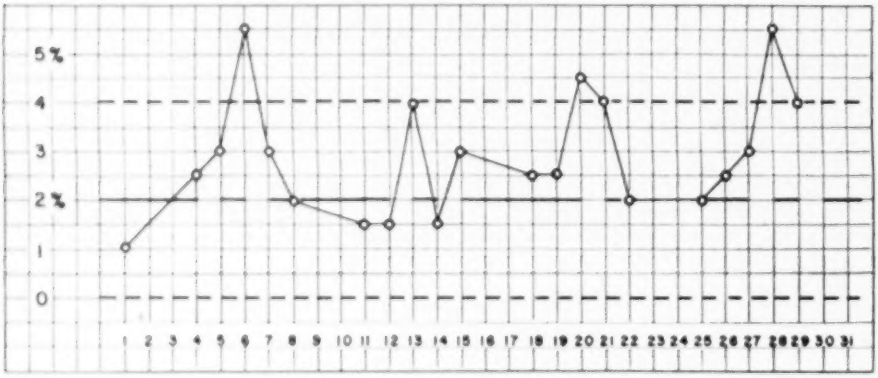

Fig. 2—The daily per cent defectives are plotted on a chart of the type shown herewith.

Without going into the detailed mathematics of it here (a subject amply covered by numerous available texts on statistical quality control), practically any set of readings, data, or tabulated figures can be averaged, the control lines calculated, and a chart of them set up which will silhouette reasons for taking action or, of equal importance many times, reasons for doing nothing.

Suppose a chart similar to that shown in Fig. 2, compiled from the same sort of data with properly located control lines, looks like that shown in Fig. 3. The analysis would be that the variations in percentages defective rejected are perfectly normal and the

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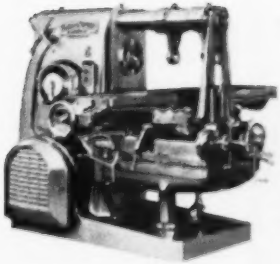

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result of conditions ordinarily inherent in the general operation because all the "points" on the chart fall inside the control lines. The job is "in control," to use a quality control term. It is true the percentage of rejections varies from day to day, but the variations are consistent in a sense, habitual for the way the assembly operations are set up.

If the chart looked like that shown in Fig. 4, however, the assumption could then be safely made that unusual and probably unnecessary and extraneous conditions, such as perhaps undue carelessness or an unauthorized change in time standards or an unusually poor run of components, had affected the general situation.

The use of charts in circumstances like those implied in this article saves a lot of "running around Robin Hood's Barn." If 1 per cent of production is rejected on one day and 3.5 per cent another day, a department manager is liable naturally to be concerned over the difference and to rush in with a lot of nagging or do a lot of desk thumping on the 3.5 per cent day. But, as the control lines show, variations anywhere between or inside 0 and 4 per cent are perfectly normal and to be expected, and it is usually better management to overlook them. When the rejections jump to 4 per cent and more the chart rings the bell, and decisive management action is definitely called for. To put all this another way, the charts prevent supervision from

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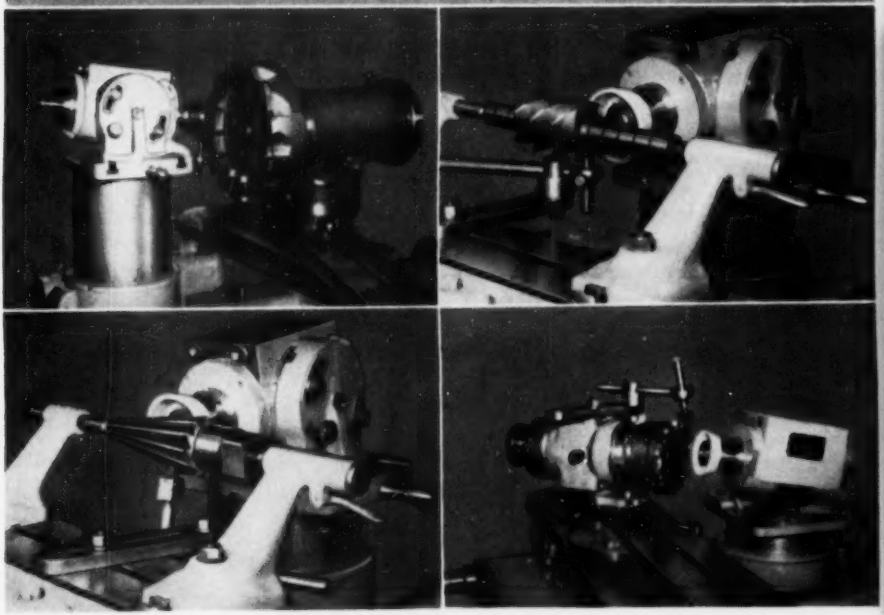

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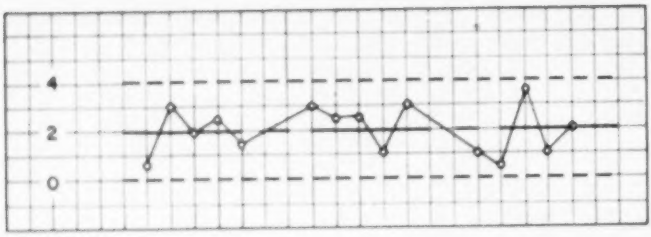

Fig. 3 — Analysis of this chart would indicate that the variations in percentages defective are perfectly normal.

"crying wolf" and when, with the chart display as graphic confirmation, decisive action is taken only as the bell rings, the correction then usually means more.

A "statistical" analysis of the chart shown in Fig. 2 would reveal that the average per cent defective for the month reported is actually 3 per cent rather than the 2 per cent marked on the chart by the dot and dash line. By pure statistics too, the control lines would fall on 1 per cent and 5 per cent instead of 0 per cent and 4 per cent as shown. The explanation of the apparent statistical discrepancy arises from the fact that from study and experience it has been found possible and practical to use so-called standard values for the average (2 per cent in this case) and the control limits.

The "standard" or practically arbitrary chart setup was arrived at from (1) continuing time studies at assembly, (2) cost and scrap studies in the earlier departments manufacturing for assembly, and (3) somewhat com-

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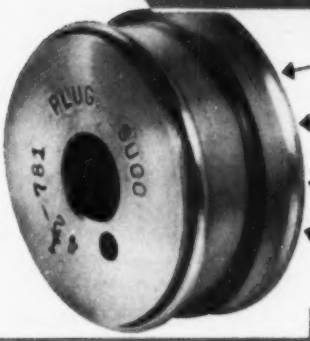

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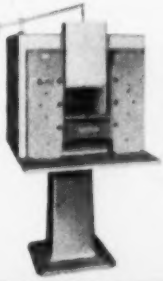

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prehensive analyses of field complaints and service department reports.

Altogether it has been found that when the normal variation in instruments rejected at assembly exceeded the boundaries set up in the chart shown in Fig. 2, any and all of the areas described just above were somewhat in jeopardy. In other words, "running off" the chart in Fig. 2 meant an unnecessary increase in assembly cost, whether the fault was due primarily to assembly carelessness or lack of know-how or whether it was due to poor components. A "poor" chart at assembly almost inevitably synchronized with higher scrap and operating costs down the line. And a poor chart also foreshadowed a wave of field complaints.

On the other hand, it was found that an attempt to force the manufacture of components at much less lower levels of allowable defectiveness of quality levels or to force the assembly department to a "tighter" degree of quality, either by more assiduously screening out such defective components as appeared or by exercising deliberately more care and using up extra time per assembly, added unneeded costs and expense all along the line.

Another bit of applied quality control enters the picture here. As was pointed out in an article titled "Use Quality Control on 100 Per Cent Inspections Too" appearing in the

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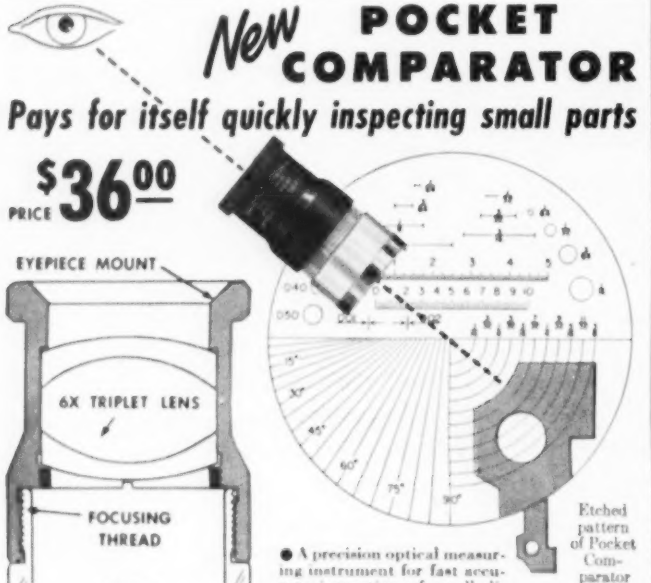

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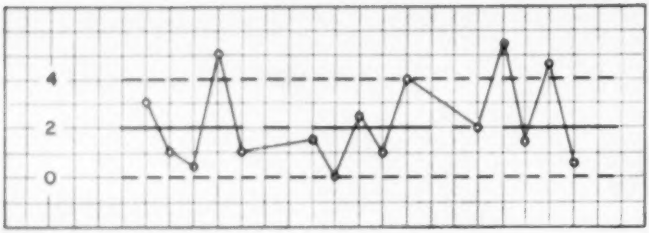

Fig. 4 — Analysis of this chart would indicate that the variations in percentages defective are unusual and probably unnecessary.

October issue of MODERN MACHINE SHOP, inspections are not necessarily "clean" and an occasional substandard unit is liable to slip by any of them. If such substandard units escaping to the trade do not exceed about ¼ of 1 per cent (2 or 3 units in 1000), little damage is done to customer relations and service costs stay in line. But when the "standard" chart like that shown in Fig. 2 is exceeded, when the variations in assembly error get out of control, and more substandard units slip through inspection's fingers for some reason, the ¼ of 1 per cent level is exceeded, and the rebound from the field is immediate, acrimonious and costly from both the service and competitive angles.

Having painted guide lines, to use an expression, on the assembly department highway to guide traffic in a practical fashion at as high a speed as possible, the daily inspection report (Fig. 1) and the philosophy of normal variations were put to use in another

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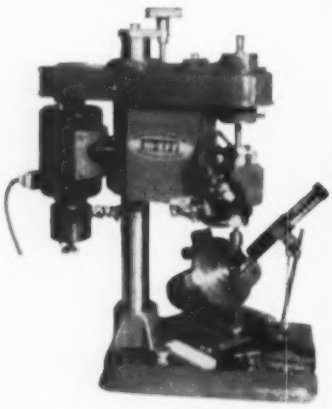
praiseworthy manner in the application of so-called "c" charts.

When an inspector rejects assemblies, the production group of course wants to know why and what for. And, as was explained earlier, "c" counts were kept on the daily inspection reports covering causes of rejection. Not only were the daily reports so detailed (see Fig. 1) but monthly charts — so-called "c" charts — were maintained, seven different charts per month. Figure 5 shows two samples of this kind of chart.

One of the charts in Fig. 5 makes graphic the count of daily incidents — defects — concerning "dials" and the other records the classification called "hands and pinions." Notice again on these charts the control lines and the ups and downs during a month. Observe also that on the chart for "dials" the variations in "c" count are encompassed within the control lines. While a few defects in connection with dials were noted each day, their variations were normal, in bounds or "in control." The "c" count for the "hand and pinion" type of defect was, however, out of control.

If all seven of the "c" charts maintained stayed in control, like the "dial" chart in Fig. 5, the main per cent defective chart (Fig. 2) would also show "in control" with normal variations. Assembly conditions that produce "c" charts out-of-control like the "hand and pinion" chart in Fig. 5 are what reflect through to produce out-of-con-



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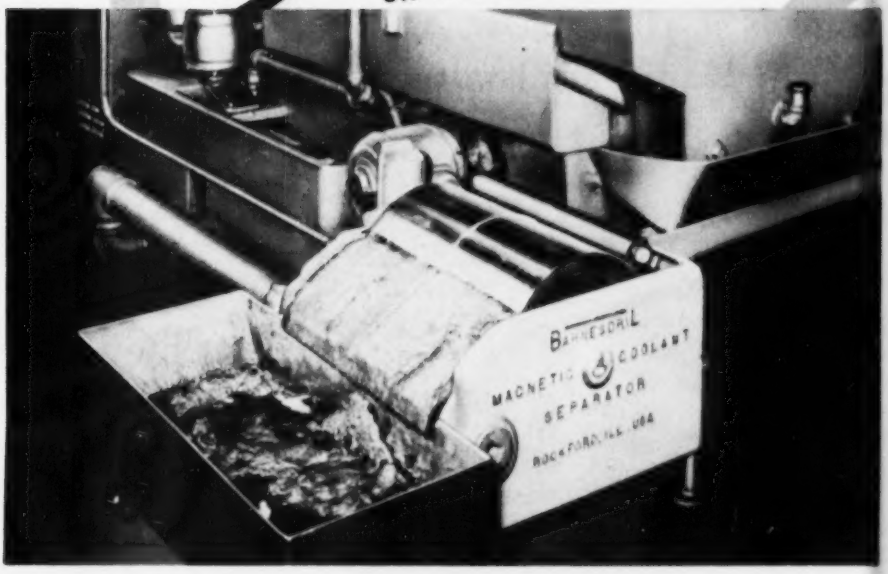

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trol chart sections as in Fig. 2. In other words, the "c" charts are used to analyze why the main assembly job is out-of-control. They tell something about the particular conditions of components reaching assembly or point out the areas in assembly work where assembly operators may be unduly careless.

Once more, foot work is saved by the "c" charts, and unnecessary nagging. Look at the sixth day of the month on the chart in Fig. 2. The per cent defective "point" is out-of-control. Why were more indicators than usual rejected on that day? A glance at the "dial" chart in Fig. 5 indicates nothing abnormal — out-of-control — on the sixth day. But the "hand and pinion" chart shows a high count for this particular defect on the sixth day. By such records and charts a lot of scrambling around is saved. An interested investigator would simply limit his research to reasons why hands and pinions gave trouble, and probably rapidly find the cure, rather than dilute and confuse his effort by searching out all causes for rejection.

Where a "c" chart is chronically out-of-control, basic research may have to be adopted and a change in design may come up or a complete change in the machining process and control of some component down the line may well be the result. Chronically poor hand and pinion charts in our case led, for

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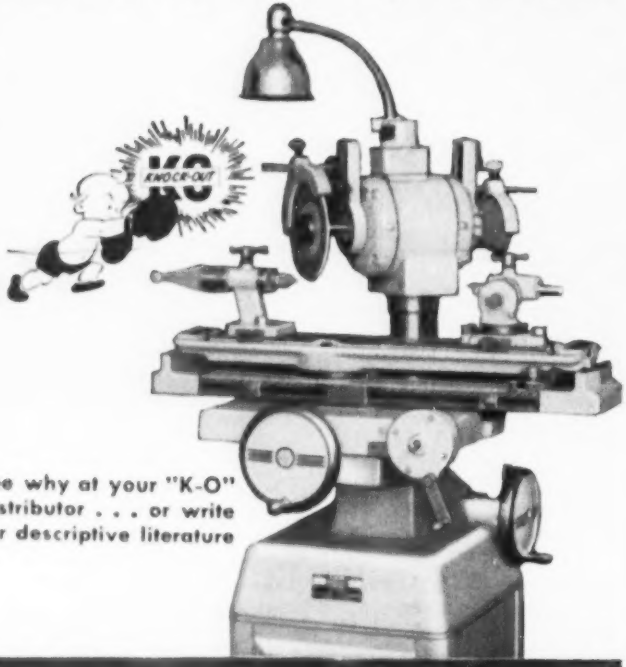

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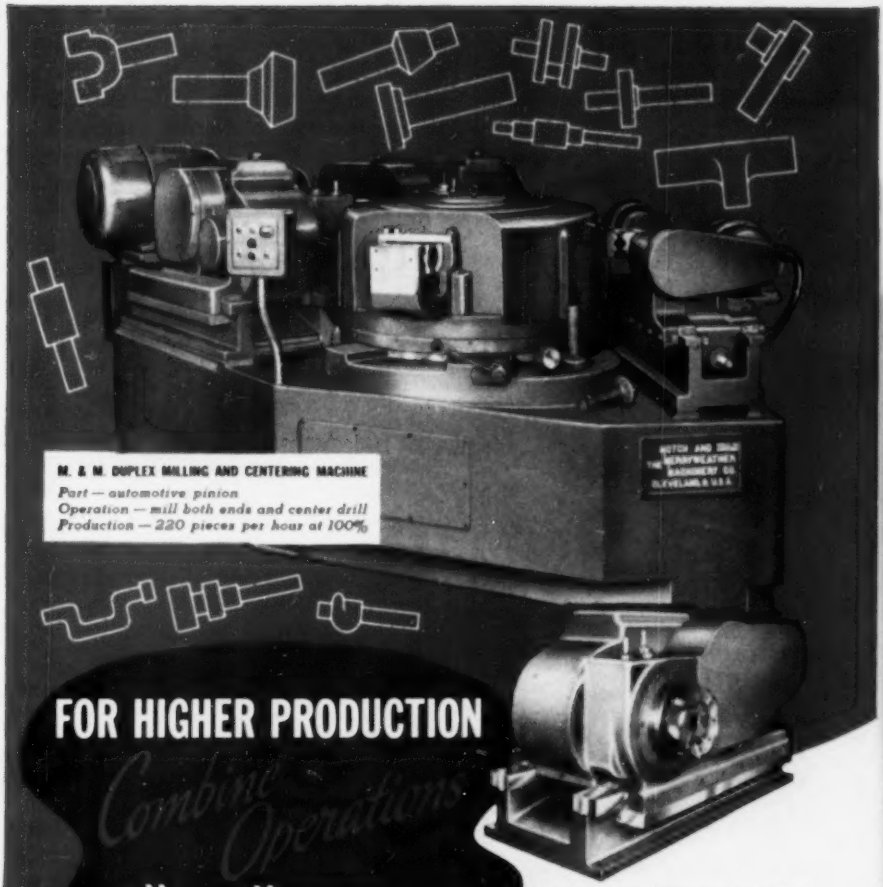

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instance, finally to a rather brilliant design creation in a new inertia-free hand which not only "cured" the "c" chart but which made the indicators more sensitive, accurate, reliable and added many more months of service life to them because of the reduction in pivot and bearing wear.

The consistent use of "c" count charts uncovers another bit of useful industrial psychology. A glance at the "hands and pinion" chart in Fig. 5 shows not only "c" counts plotted above the upper control line — illustrating days when the "c" count was worse than normal — that also days when the "c" count fell below the lower control line. In other words, there were many days when the quantity of defects detected was "normal," other days when an unusual number occurred, and, finally, some days when the particular defect occured much less than normal.

It has been found, as a matter of supervisory techinque, that when the assembly group was nagged or "bawled out" on those days in which the defect count ran high, there was a tendency to "clam up," to use an expression. Investigation might meet with a shrug of the shoulders and a sort of defeatist attitude.

However, if the investigator went out on the floor after one of those days when the work came along in unusually satisfactory fashion, after one of those days when the "c" chart point fell below the lower control line, he usually learned something. To point to a chart and say to assembly people "The work was much better than usual yesterday — why?" usually brings out smiles and a spontaneous effort to explain why. The seasoned investigator will usually find among the rea-

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sons given some definite clues as to why, on other days, the work comes through poorly. When a man explains cheerfully the reasons he is putting out a better job, he ordinarily unwittingly discloses some of the causes of the "off" day.

The idea of normal variations as mapped on a "c" chart is also an aid in rating assembly help. Provision is made in the report form shown in Fig. 1 to tally the number of assemblies rejected each day to each operator. The daily counts of rejections per operator are also recorded on "c" charts with control lines.

Almost without exception a "c" chart of rejections whose plotted points are practically all in control marks a stable, competent assembly operator. That is to say, not only is such an operator a consistent worker, from the point of view of product produced, but the same person is liable to have an excellent absence and tardiness record, for instance, and be known for reliability, even temperament and compatibility.

We frequently find, on the other hand, that the operator whose "c" chart of daily rejection count resembles a profile of the Rocky Mountains is the one who must be handled with kid gloves. He, or she, is liable to be a troublemaker. The chart quite often ties in with a merit rating that is consistently poor in most of the other respects in which an employee is graded.

The operator "c" chart, when it is erratic, often reveals another funda-

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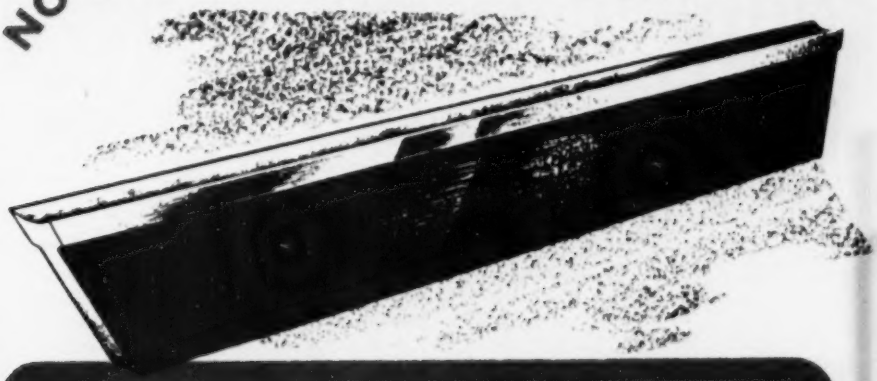

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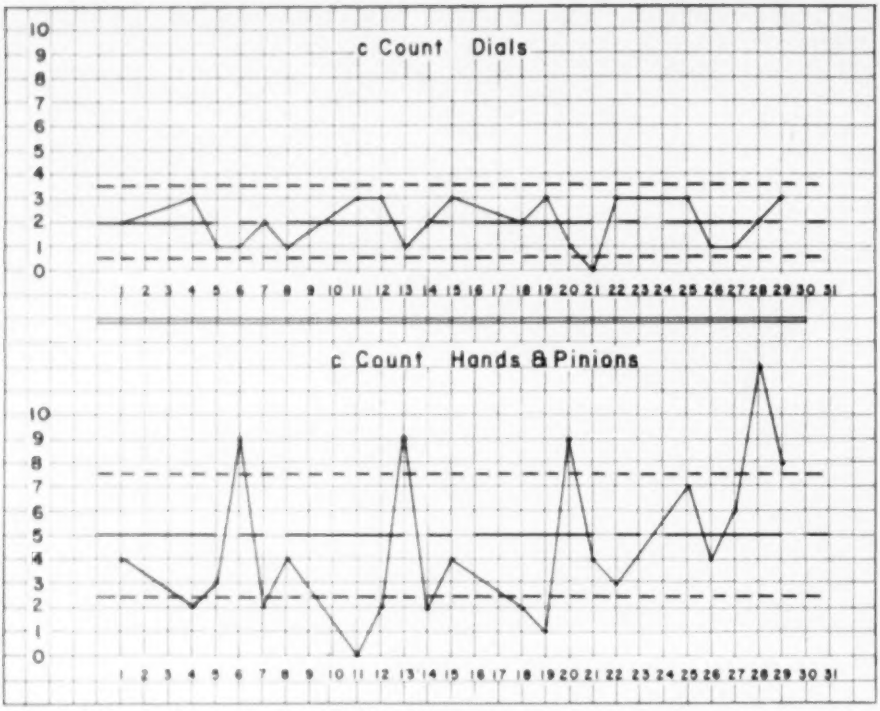

Fig. 5—Illustration showing sample "c" chart.

mental difficulty. It is a good sign, many times, that the operator has not been adequately instructed, coached, guided and trained. For such reasons the operator lacks confidence and the chart shows it. A poor operator chart, then, can point the finger at supervision which has been dilatory and slack in making sure the know-how for the job has been properly transmitted. The charts and the same philosophy will help to show up, for example, the

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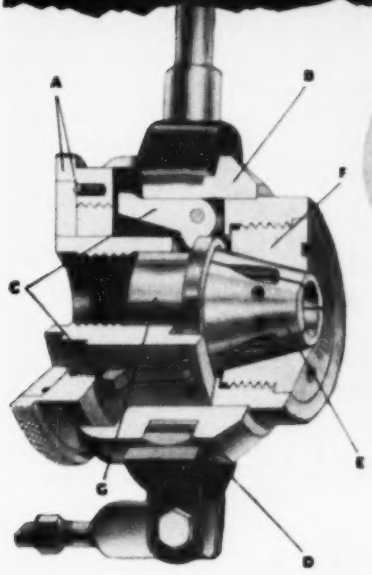

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- **A — Pressure adjusting ring with ball detent lock**
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round peg in a square hole.

It is a good thing to maintain the monthly per cent defective charts for the whole department (like the chart in Fig. 2) as well as the series of "c" charts on causes for rejection (Fig. 5) and the "c" charts illustrating operator skill and to hold used charts in the file for a few weeks or months past their current use. The impartial and impersonal quality control records, especially in the case of operator charts, often become useful substantiations of recommendations say for a revision of time standards, for a change of material or design, especially in components, or even for promoting, transferring or dismissing employees.

In some plants, per cent defective charts like the one in Fig. 2 are enlarged and kept posted in the assembly department. In such a case, the chart form frequently is continuous to an extent so that the quality of output for the existing week can be compared to the work of a month or two past. Chart exhibits stimulate considerable interest and a department will usually compete with itself for continued improvement in what the chart records. In a similar manner, "c" charts for causes will appear on the quality bulletin board. But "c" chart records of rejections against operators should never be made public. Each chart should be held as a confidential report available only to worker and supervisor.

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The mathematical theory involved has been purposely avoided thus far in this article. As a general thing, tabulations of per cents defective and of "c" counts are kept for a month, if equivalent data are not already available in existing inspection records. From such tabulations, the average of per cent defective for the month ($\bar{p}$, "barred p," in quality control jargon) can be calculated. The upper and lower control limits or lines can then be fixed, in percentage, by the formula:

$$\text{Control Limits} = \bar{p} \pm 3\sqrt{\frac{\bar{p}\,(1-\bar{p})}{n}}.$$

The letter "n" in the above formula is the total number of assemblies or units produced. If "r" is the number of units rejected while "n" was being produced, then per cent defective, or "$\bar{p}$," is equal to r/n. Where production exceeds 100 assemblies per day, the "n" of the formula usually represents the daily production. The usual procedure is to use such an average ($\bar{p}$ or $\bar{c}$), and the control limits, calculated from one month's figures as the framework of the chart to be plotted during the succeeding month.

There are, however, permissible and practical modifications for selecting the "$\bar{p}$'s" and "n's" used in the formula for calculating control lines. Sometimes, for instance, the "n" represents a week's production. Again, the "n" (in high production) is a sample (say, of 100 units) taken at random from the day's production. To get the most out of quality control and to be entirely accurate in its use, a plant should have a qualified quality

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control engineer or else engage the services of a consultant.

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The mathematical formula for the control limits for "c" charts, incidentally, is a little simpler. The record or tabulation of "c" count on any item is kept for a month and averaged to get a "barred c," $\bar{c}$. The formula for control limits then is $\bar{c} \pm 3\sqrt{\bar{c}}$. Local conditions many times, however, dictate the use of the formula $\bar{c} \pm \sqrt{\bar{c}}$. (The control lines on the "c" charts used to illustrate this article were calculated from the latter formula). So, once again, it is recommended that, to obtain the most accurate and profitable use of "p" and "c" charts, someone should put in the few hours study necessary to become more adequately acquainted with statistical mathematics than can be described in an article of this length.

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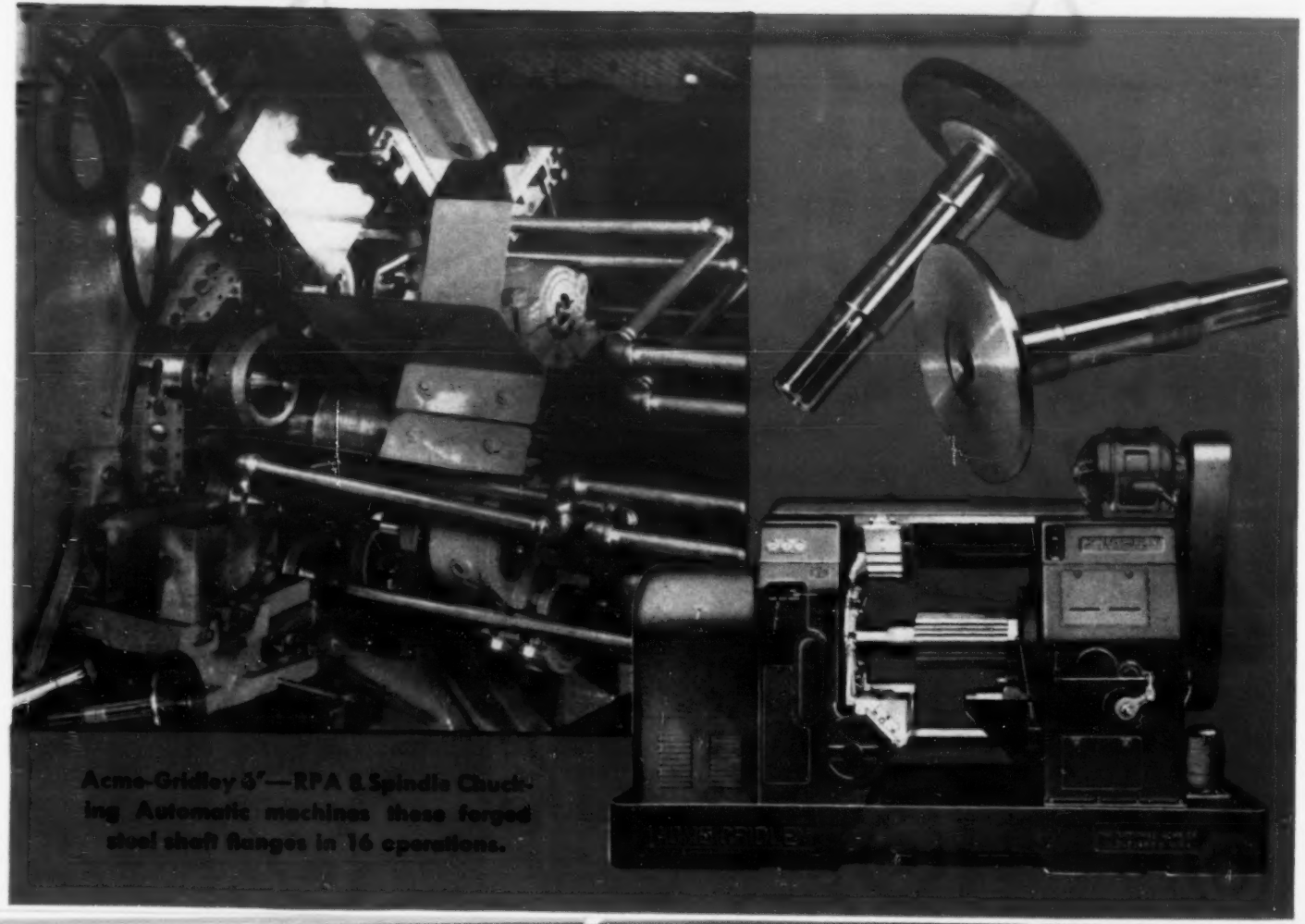

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The Hygiene of Modern Abrasives

By Henry R. Power
The Carborundum Company, Niagara Falls, New York

IN order to attain maximum efficiency, it is always considered good practice to make the selection of an abrasive material on the the basis of a specific application. This selection may be made from a wide variety of available materials. Among these can be loose abrasive grains for setting up polishing wheels; abrasive finishing compounds, abrasive discs; superfinishing stones, abrasive cutoff wheels, abrasive belts and drums, as well as grinding wheels for use for surface, cylindrical, internal and centerless grinding. While the physical properties of such abrasive products and their mechanical performance is well known to the user, the question of their composition and the hygiene of their use is increasingly a matter of concern to those engaged in the safe operation of the shop.

This phase of safety is supplementary to that concerned with the proper protection and care of abrasive wheels before placing them on the spindle of the machine, and their proper operating speed on the machine. The Grinding Wheel Manufacturers have long since drawn up a proper practice which was issued in more recent years as standard safety code B7-1943 by the American Standards Association. Moreover, each manufacturer of grinding wheels not only specifies on the label of each wheel the safe operating speed for the particular wheel, but he also tests the wheel before shipment by actually speeding it beyond the recommended speed.

In the operation of grinding wheels and other abrasive products in the shop of the ultimate user, dust is formed by the attrition of the abrasive on the workpiece, and this airborne dust will circulate freely unless it is removed by the coolant used in wet grinding or in the case of dry grinding, by a suction device at the point of origin of the dust. The labor law in many states provides that a suction device must be used wherever attrition of any kind takes place. Nevertheless, the safety engineer is concerned with the composition of the dust in his shop, having in mind the Free Silica (SiO_2) dust which has a specific effect on the respiratory organs and may lead to a disease known as "Silicosis" if breathed over too long a period of time in too large amounts or in particles small enough to reach into the lungs. Free Silica dust is the product from the mechanical breakdown of ordinary sand, and quartz granules and sandstone wheels which

are upwards of 90 per cent Free Silica. "Free Silica" (SiO_2) is distinguished physiologically from "Combined Silica" which is chemically combined with other elements and in this form is much less active if breathed as a dust. Clay, Feldspar, Glass are examples of materials wherein the silica is "combined".

Modern abrasives comprise two electric furnace products one of which is electrically fused Alumina containing upwards of 95% crystalline aluminum oxide (Al_2O_3) in a matrix, which is substantially free of Free Silica. The second abrasive also made in the electric furnace is silicon carbide (SiC) in which the Free Silica is a few tenths of one-percent. Silicon Carbide (SiC) is not to be confused with Silica (SiO_2). Silicon Carbide does not change to silica in any ordinary use such as grinding, abrading, polishing and blasting. Only at very high temperatures in a current of oxygen can silicon carbide be changed to silica. As a matter of fact, silicon carbide is so inert that it withstands practically all acids including nitric acid and hydrofluoric acids. These two materials, silicon carbide and electrically fused alumina are the basic modern abrasives in common use.

For air blasting operations, granules of fused alumina are used on metals and alloys. The dust arising from such operations can vary in composition depending upon the workpiece under the air-abrasive-blast. A chemical examination of the dust drawn from the air should be made if its identity must be accurately known, but in general it may be said that the air-borne dust can contain no free silica from the use of these two abrasives on materials containing no silica. On the other hand a

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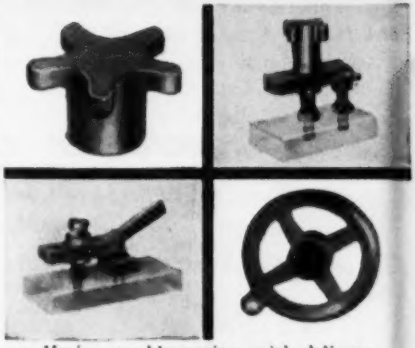

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casting coated with residual sand from the mold and blasted with fused alumina, yields air-borne dust that may contain Free Silica.

Polishing wheels may be made in the shop from fused alumina granules by attaching them to the periphery of a cloth wheel by animal glue. The wheel contains no Free Silica and none can be found in the dust produced while polishing metal. If silicate of soda (cement) is used as the adhesive in place of animal glue, the dust may contain combined silica.

A grinding wheel is a more technical article of manufacture containing generally upwards of either 85 per cent Fused Alumina or 85 per cent Silicon Carbide. The balance of a grinding wheel is comprised of bond designed to hold the abrasive particles in place.

For instance, rubber both synthetic and natural may be the bond in such extreme sizes of wheels as snagging wheels on swing frame grinders, to thin cutoff wheels capable of cuting the slots in writing pens. Other bonds used in grinding wheels are the natural resin product shellac; the synthetic resin, phenol - formaldehyde and the modern variations of the latter. None of the foregoing bonds contain Free Silica. Ceramic bonds are used in grinding wheels and may be silicate of soda, or glass or porcelain, in each

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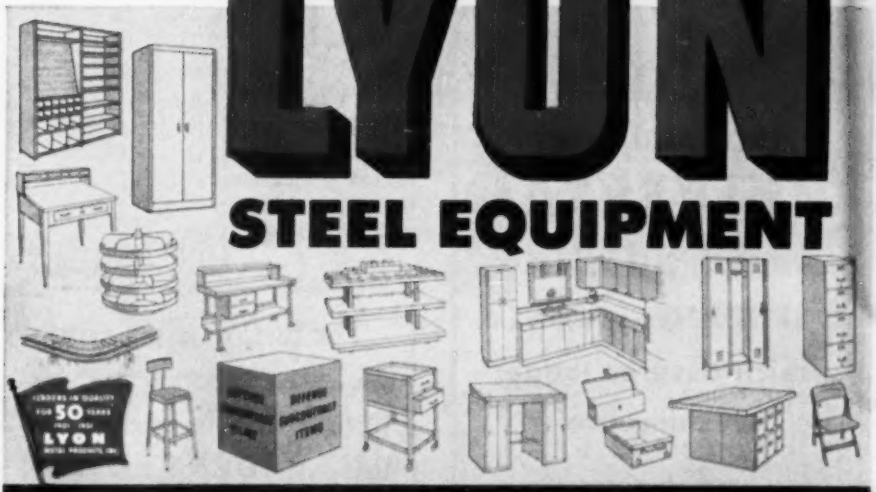

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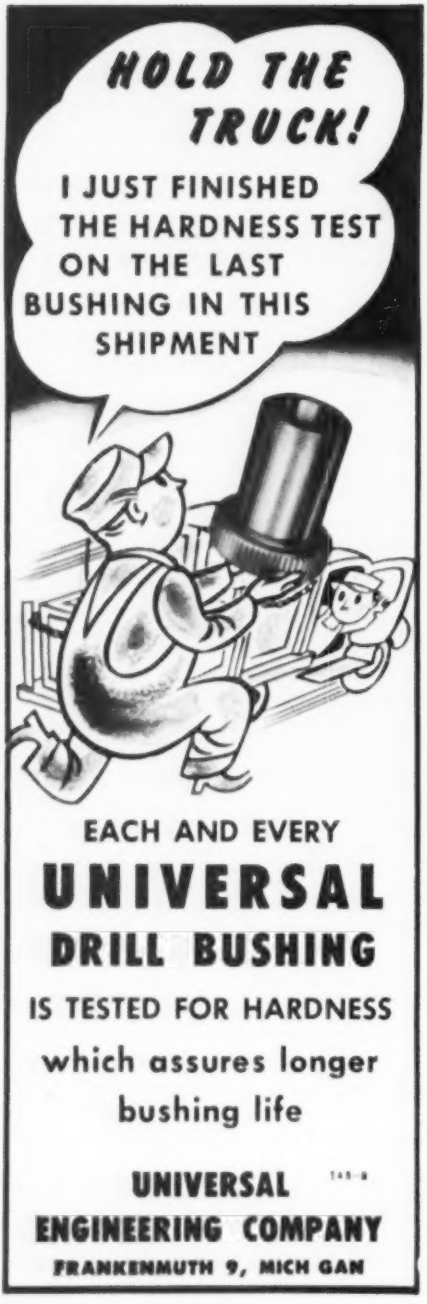

of which the silica is chiefly "combined". Some Free Silica in these bonds is present but since the bond is generally under 15% of the entire grinding wheel, the latter will show a low value such as say 2% or even as low as 0.3% Free Silica. The exact amount in any specific wheel is obtainable from the wheel manufacturer.

In grinding or other abrasive operations, the workpiece is generally worn faster than the abrasive and the detritus, as well as the dust are therefore likely to contain a minimum of abrasive material. Whatever the abrasive used, or the kind of material ground, sanded, polished, or blasted, a count of the dust particles per cubic foot and the chemical and petrographic examination will reveal whether a correction in the ventilation practice is required. For instance, the State of New York has set a maximum of 5 million particles per cubic foot of 100% Free Silica dust, but also specifies for non-siliceous dusts a maximum of 30 million particles per cubic foot. In other words, while Free Silica dust is recognized as the most damaging, a great excess of any type of dust should be avoided. Such an excess is best controlled by suction at the point of origin of the dust, rather than by general ventilation.

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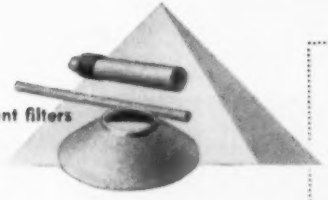

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Fitting Metal Cleaners to the Job

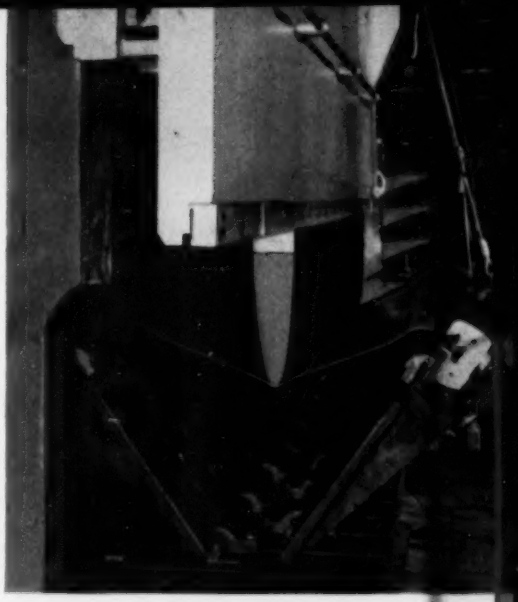
In which the author discusses the importance of balancing the cleaning action of a metal cleaning solution to the type of work involved, retaining, at the same time, other desirable cleaner properties.

By Gilbert C. Close

A CONSIDERABLE amount of technical literature has been published concerning metal cleaners. Many such writings are obscured by technical data which makes sense only to trained chemists or chemical engineers. In other articles, the cleaning solutions themselves are considered in the abstract, with the importance of their use being stressed rather than the qualities of a cleaner that will make it accomplish desired results.

From the standpoint of the average finish technician or foreman-finisher, cleaner composition is of importance only insofar as it pertains to his own cleaning problems. Beyond this point,

The various lubricants and cutting oils used in production add to cleaning problems. Some are removed by one type of cleaner action; some by another. A plant-wide survey should precede adoption of any specific cleaner. This illustration shows the huge amount of water-soluble oil used in milling an airplane spar cap slot.



Forming lubricants used in deep draw and drop hammer work are often difficult to remove. When such lubricants are employed, cleaning solutions should be selected accordingly.

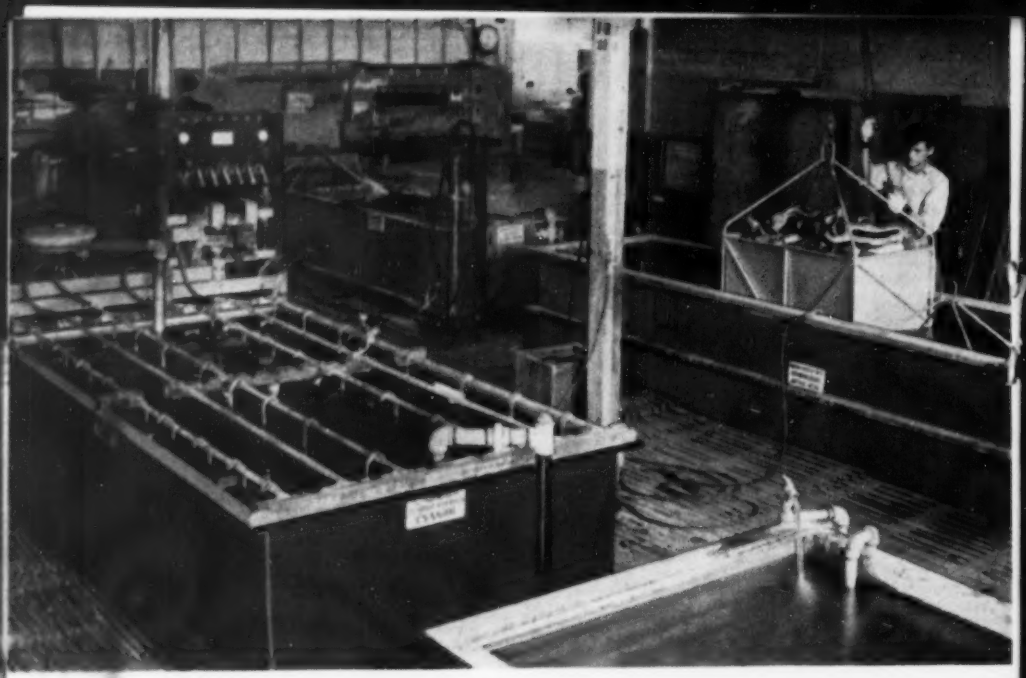
he is perfectly willing to leave cleaner theory and formulation in the hands of commercial producers who are much better equipped to cope with the various problems involved. His part of the job is to determine his own specific cleaning requirements and then choose a cleaner that will accomplish the job in the most efficient and economical manner.

In this conjunction, it should be remembered that metal cleaners of different types include a wide category of compounds. While these cleaners are all formulated to accomplish the same end results, each accomplishes these results in a different manner. In this respect, cleaners may be logically compared to guns—all are designed to kill, yet you don't choose an elephant rifle to hunt quail, nor do you go after lions with a scatter-gun. For best practical results you choose a gun of the lightest possible weight and use the cheapest ammunition that will make a clean kill of the game you are intending to hunt.

The many metal cleaners available tend to create some confusion in the mind of the technician who is not acquainted with the basic chemical principles upon which such cleaners operate. But lack of this chemical knowledge does not dim his conception of what a metal cleaner must accomplish. The best cleaner to use is the cheapest cleaner that will provide a chemically clean surface on which to apply finishing materials, and will accomplish this result in a reasonably short time and at low unit cost when all contributing cost factors are considered.

Any industry engaged in the application of surface coating materials can use an imaginary "yardstick" to gage cleaning requirements and balance them against the properties of the various cleaning solutions available. This "yardstick" should be a listing of all types of metal soil to be removed arranged opposite to a listing of the chemical compounds that will cause such soil to enter readily into liquid solution or suspension or to break down chemically into water-soluble soaps via the saponification process.

The first step in the inauguration of any cleaning program is determination of the types of soils that must be removed. The chemical composition of the dirt involved will in most cases determine the chemical solution required to remove it. The physical characteristics of the dirt such as its body, density, and adherence to the metal surface will determine the strength of solution required, and will often indicate the processing techniques that



View of cadmium plating department at El Segundo plant of Douglas Aircraft Company. A free-rinsing cleaning solution will prevent dirt carry-over and contamination of subsequently used plating, pickling, and other solutions

must be used. Without a thorough knowledge of these factors, intelligent selection of a cleaner is impossible.

Cleaning problems usually increase in direct proportion to the complexity of manufacturing processes employed, and are often affected by the volume of manufactured output. When welding is included in the manufacturing processes, the problems of metal cleaning prior to and after welding are added to those already existent. Huge manufacturing output which necessitates large stocks of raw materials that must be protected during long periods of storage drops another problem in the cleaning department's lap. The oil so often used for protecting iron and steel during storage is at best a difficult product to remove.

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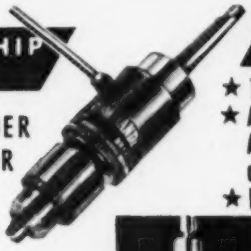

Get these COMMANDER DRILL CHIP BREAKER benefits now:

- **Faster Drilling**
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- **Better Holes**
- **Longer Drill Life**
- **Safer, Cleaner Work**
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CHIP BREAKER CHIPS

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★ 1 Tapper Handles Taps #0 to ¾"
★ Automatically Sensitive... Any Operator Can Do Precision Tapping
★ Fits ANY Drill Press

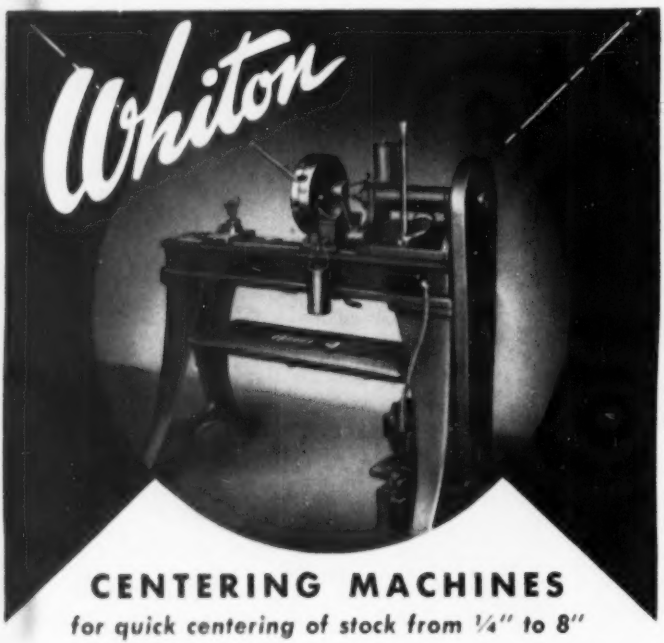
Commander Tappers "think for the operator"—automatically stop when taps are dull, overloaded, or when they strike bottom in blind hole tapping—permit faster tapping, better work, even with inexperienced operators. Torque control provides positive tap protection from #0 to ¾"...spring clutch eliminates slippage, assures smooth, quiet, easy operation.

Commander MANUFACTURING CO.
4224 W. KINZIE ST. • CHICAGO 24, ILL.

The drawing compounds used in metal forming operations are another headache that directly concerns the cleaning department. These drawing compounds, and especially those used in deep-draw forming, have considerable "body" and often contain substances practically insoluble in many cleaning solutions. The insoluble soaps of zinc, calcium, lead and aluminum exhibit high film strength and impart very good lubricating properties during forming operations, but subsequent removal is a difficult task.

In conjunction with drawing compounds, close cooperation between the design department, machine shop, and cleaning department should be maintained at all times. A slight change in design contour may permit use of a much lighter drawing compound. On the other hand, many machinists are inclined to use much heavier drawing compounds than are actually needed to keep down die gall and die wear. With each department fully conversant with the troubles besetting the others, it is possible to strike a happy medium and design, form and clean parts in a manner best suited to production of an economical and acceptable product.

After the types of soil that must be removed are accurately ascertained, the next step is to select a cleaner of the correct chemical composition. If possible, a cleaner that will remove all dirt in a single operation should be chosen. ("All dirt" in this case means any dirt that can be effectively re-



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3 or 4 jaw lever operated universal chucks center and hold work. A standard tapered hole in the spindle provides for holding combination or twist drills of suitable size. Spindle traverse is actuated by a feed lever. Machine is completely motorized. Also available are single spindle single head screw feed floor and bench types as well as single spindle double head centering machines. Write for Bulletin C-1 now.

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Knurled Head Stripper Bolts
Precision-Ground Dowel Pins
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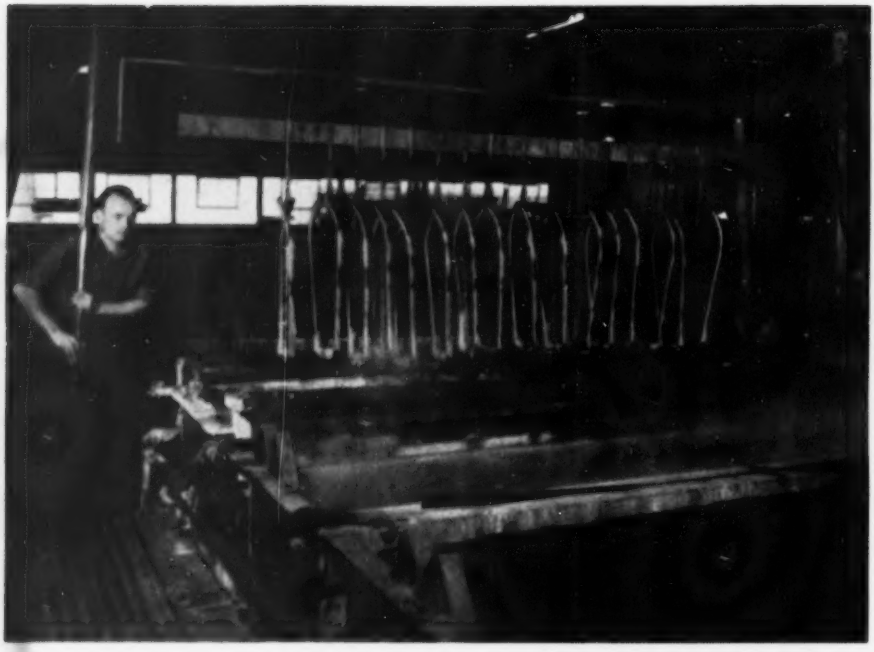

Setup for the chrome plating of tubular steel furniture parts. The quickly applied flash coating of decorative chrome metal requires a chemically clean surface. Deposits of dirt caused by water breaks during cleaning or low wetting power of the cleaning solution will affect the final finish.

moved by a liquid cleaner, and does not include heavy heat-treat scale, rust, and so on, which, under normal conditions, must be removed by means of an abrasive process.)

The types of soil common to most manufacturing processes can be roughly classified under four categories: (1) the mineral oils; (2) the animal and vegetable oils; (3) combinations of animal and vegetable oils with mineral oil; and (4) insoluble matter either alone or in combination with one or more of the oils. Each of these soils, or

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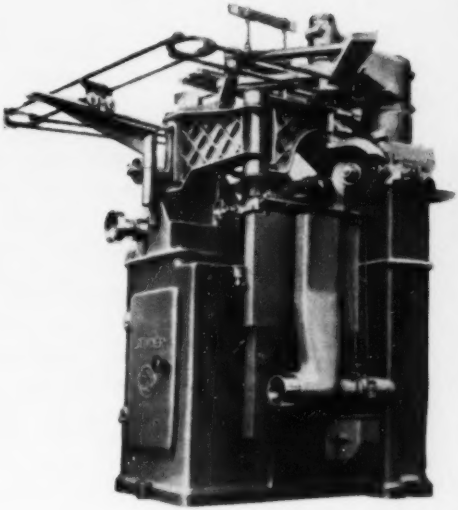

Type PSM—Studer Profile Grinder.

GRIND WITH PRECISION to ±0.0002"

Profile Gauges, Sectional Dies, Flat and Circular Form Tools and many other profile parts.

INCREASE PRODUCTION

One wheel will grind profiles up to 6" long in one continuous operation. Eliminate milling operations on small pieces.

CAPACITY

Grinds profiles up to 6" in length. Handles circular work up to 4" diameter and flat pieces up to 2" thick.

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combinations of soils, requires a cleaner specifically balanced to the work to be done for most economical and efficient results.

Quite often, too much reliance is placed on laboratory test results in selecting a cleaner. Laboratory tests are valuable for ascertaining certain cleaner features, or for checking cleaner concentration and purity after a period of use, but it is very difficult to duplicate actual production cleaning processes in the laboratory. Any cleaner worthy of consideration merits a trial under production-line conditions. Subsequently, parts cleaned in this trial run should be critically examined for cleanliness, etching, signs of corrosion, and so on, and the cleaner baths should be checked for purity and concentration after a known quantity of work has been cleaned.

Mineral oils are a soil common to most types of industry. These oils are effectively removed by a reaction termed by cleaner chemists as "emulsification." Emulsification is a physical rather than a chemical action wherein minute particles or globules of mineral oil become suspended in the cleaning solution. Subsequent rinsing washes the solution from the metal surface and the suspended particles of mineral oil are carried with it.

From the chemical standpoint, removal of vegetable and animal fats is an entirely different problem. Such oils refuse to emulsify, and must be brok-

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It's the "teeth" in Weldon End Mills that tell the story of more production and bigger profits on your jobs.

Weldon pioneered in producing *scientifically designed* teeth for end mills, a step over 25 years ago that opened the door to higher speeds, and faster feeds.

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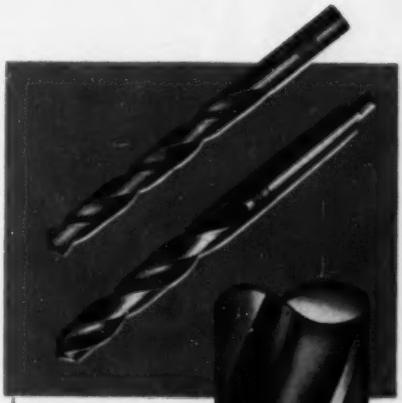
THE WELDON TOOL CO. Cleveland, Ohio

3000 WOODHILL ROAD

There's a UNION *twist drill for top performance on every operation!*

Whether you're working on the hardest alloy steel or softest iron . . . on such non-ferrous metals as brass, copper, aluminum, magnesium or zinc . . . on slate, marble, rubber, plastics, wood or any other non-metal . . . there's a type of Union Twist Drill that will give you tops in accurate, trouble-free, money-saving performance.

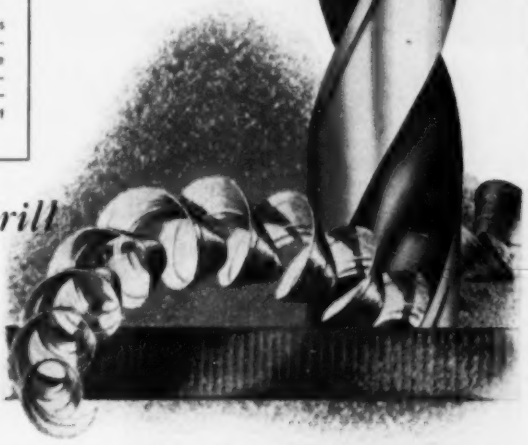
That goes, too, for a normal working pace or for high production records . . . and for every type of drilling equipment. No matter what the material or the conditions, *you're sure of best results when you specify Union!*



Union Twist Drills, Straight and Taper Shank High Speed Steel, with Blue Oxide Surface Treatment.

SERVICE THAT SAVES YOU TIME, TROUBLE, MONEY

Union Twist Drills are made in designs that cover the broadest range of operations. To aid you in choosing exactly the right type and size of drill for your particular applications — usual or unusual — your Union service man offers expert assistance. Call on him any time.



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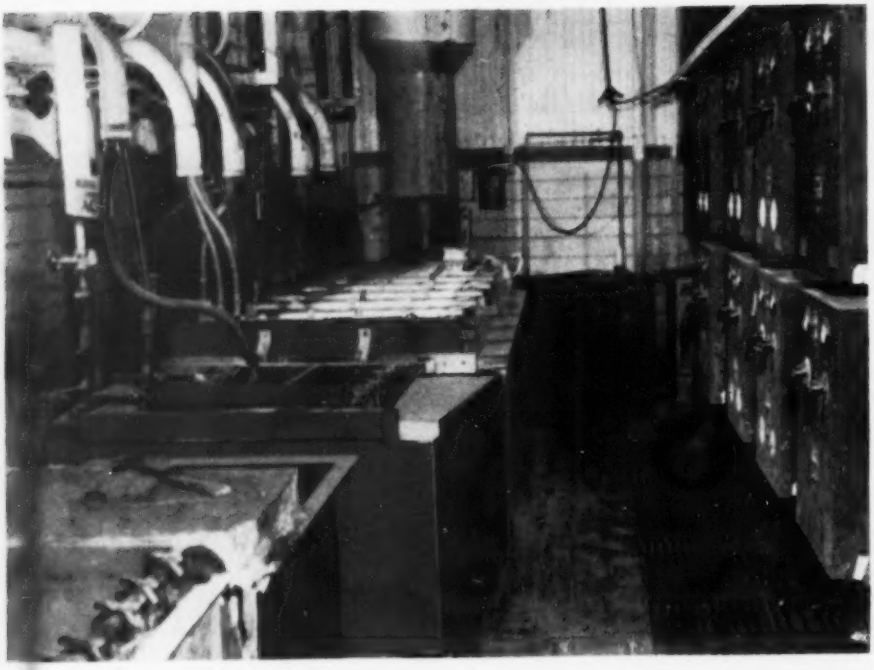
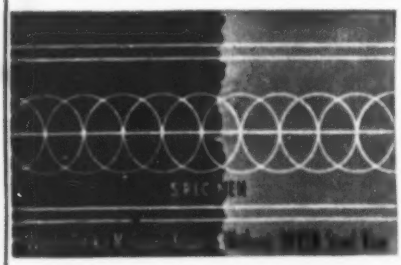


Hard chrome plating setup at El Segundo plant of Douglas Aircraft Company. Parts to be plated must be thoroughly clean to prevent interference with the high current densities necessary in this process.

en down by chemical action into water-soluble soaps. This action is commonly referred to as "saponification." After the fatty oils have been saponified, they dissolve in the cleaner solution and are freed from the metal surface during final rinsing.

When both mineral and fatty oils are present, the cleaning solution used must clean both by emulsification and saponification. The ratio of oils present will determine the preponderant action. If the soil is composed mostly of animal oils, a predominantly emulsify-



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Simply brush on, right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

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Everywhere—hats are off to the SIZE-MARK on PARKER-KALON Socket Head Cap Screws

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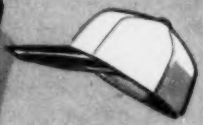
welcome it because sorting is made so much easier and quicker . . . a glance at the head of a P-K Screw immediately tells you its size.



ASSEMBLY WORKERS
are all for it because sizes are always issued correctly. The Size-Mark prevents delays, helps them make better time on the job.

APPRENTICES
cheer the Size-Mark on P-K Screws because it protects them from errors . . . enables them to learn sizes faster and do a better job.

SALES MANAGERS, TOO
hail the Size-Mark on P-K Screws. It's a definite sales advantage because it saves time for customers' service men in reassembly.

And the GEAR GRIP† prevents *slipping* — even when fingers are oily! Send for samples . . . see for yourself how P-K* Size-Marked Socket Head Cap Screws can put your product ahead, assembly-wise and sales-wise. Parker-Kalon Corporation, 200 Varick Street, New York 14, N. Y.

NEW . . . . . Size-marked Engineered Hex Keys

Key size, and corresponding socket set and cap screw sizes, are clearly stamped on the arm of Parker-Kalon Engineered Hex Keys. P-K Hex Keys are again available in attractive, compact steel cases with easy-to-use key island (Set No. 111), and in durable plastic pouches (Set No. 45).

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SIZE-MARKED SOCKET HEAD CAP SCREWS • GROUND THREAD SOCKET SET SCREWS • FLAT HEAD SOCKET CAP SCREWS
STRIPPER BOLTS • PIPE PLUGS • HEX KEYS • AVAILABLE EVERYWHERE THROUGH ACCREDITED DISTRIBUTORS

*TRADE MARKS REG. U. S. PAT. OFF. †U.S. DESIGN PAT. NO. 150,409

ing cleaner will be slow in action. The same holds true with conditions reversed. By closely supervising production runs, noting cleaning time required and results and varying solution strength to improve both, a sure method of balancing the cleaning solution to the work at hand may be obtained.

When it is desired to remove a certain amount of insoluble substances in the cleaning solution, such as light heat-treat scale or light rust, the method by which cleaning is accomplished is more important than actual cleaner composition. Hand scrubbing or use of high pressure washing machines is effective in this conjunction. With either method, it is mechanical action that cause the insoluble matter to leave the metal surface and enter the solution. If one or both of the oils are present along with the insoluble matter, the solution should be balanced to emulsify or saponify according to type of oil present.

When selecting a cleaner, it is convenient to be acquainted with the trade terms used to designate different types of cleaning action. Generally speaking, "light duty" cleaners clean by emulsification only. They act slowly in the presence of fatty oils, and are not recommended for cleaning iron and steel except when metal soil is slight and purely of mineral oil origination. The light duty cleaners are often used for aluminum and its alloys and, due to their non-caustic nature, for many types of general mainten-

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More Work–Bigger Profits

QUADRILL & QUAD-TAPPER

Increase Production 33%

Fits Directly on Drill Press

- Uses up to 4 drills and tapper on single press
- Saves moving of jig from one press to another
- Drills to full capacity of press
- Costs less than a drill press — does the work of 4
- A thoroughly PROVEN tool. Thousands in use.

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SAVE TIME on Milling Operations

END MILLS

	Number of passes necessary to mill slot	Time per slot	Number of complete slots before changing mills
End Mills previously used	24 to 32	9 min.	4-1/2
Cleveland End Mills	10	1-1/6 min.	27

The above figures, taken from an actual test on a roughing operation in a customer's plant, proved that ***Cleveland*** End Mills save time and money in cutting slots in a cast steel mold. There may be an opportunity for similar economies in *your* milling operations. Let a ***Cleveland*** Service Representative make a survey, without cost or obligation. Contact our nearest Stockroom, or . . .

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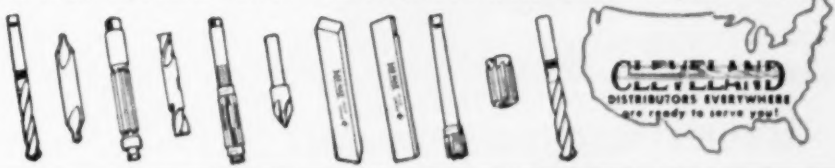

ance cleaning work.

The "medium duty" cleaners clean both by emulsification and saponification. They are the most commonly employed cleaner for general work. They are mildly caustic and work very well on ferrous metals contaminated with mineral oils and a medium amount of animal or vegetable fats. The "heavy duty" cleaners are generally highly caustic and clean almost entirely by saponification. They are used with ferrous metals only, as they will attack and etch most of the lighter alloys. Care must be used in handling these heavy-duty solutions as they may be harmful if allowed to come in contact with human flesh.

Regardless of the type of work it must perform, any cleaner selected must have good wetting and free rinsing characteristics. Wetting properties are extremely important in obtaining chemically clean surfaces on all parts of the work. Dirty spots resulting from water breaks are extremely injurious to many final coating materials. When cleaning enameling iron, for instance, these dirty spots may result in bare spots, copperheads and poppers on the finished material.

The wetting characteristics of a cleaning solution can be easily checked in the laboratory. Good evidence of

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to increase production!

DESIGNED specifically for production heat treating of small parts, Hevi Duty Shaker Hearth furnaces have proved themselves for Bright Carburizing, Cyaniding and Hardening processes. Close control of case depths can be maintained.

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DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS

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wetting characteristics can be obtained by tossing a small wad of steel wool into the cleaning tank. If the wad wets and sinks quickly, the solution has good wetting characteristics. If it floats for some time before sinking, the wetting power of the cleaner should be questioned.

Free rinsing properties are important for two reasons—first, to obtain a clean surface and secondly, to prevent contamination of subsequent finishing solutions. Free rinsing properties are largely dependent on cleaner composition. In this conjunction, it is well to remember that certain ingredients that will hasten cleaning will at the same time detract from the rinsing properties of the solution.

Chemicals that will detract from the free rinsing properties of a cleaning solution when used in excessive amounts include rosin in the powdered form or in the form of a rosinate, sodium silcate of either the meta, sesqui, or ortho variety, high titer soaps, and various bentonite clays. Any of these chemicals will speed cleaning action, but a logical maximum of the amount used must be observed to prevent harmful reduction of free rinsing properties. When claims of excessive speed are made for any cleaner, its free rinsing properties should be thoroughly checked.

The safest course is to regard metal cleaning as a highly complex process and treat it accordingly. This complexity is due to the many types of soil en-

Raker Set, because of its design, assures a fast cutting rate. Each tooth cuts a full chip, thus less heat is generated. Raker Set retains saw kerf width, combines strength with more efficient chip clearance where most cutting is on larger solids or thick plate.

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Lusol THE NEW COOLANT

THAT HAS REVOLUTIONIZED PRODUCTION THINKING

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The use of 10 million gallons of Lusol solution in exhaustive testing and in everyday plant applications lies behind the extraordinary claims we make for this extraordinary coolant. It has revolutionized the ideas of some of the country's most critical production experts on the subjects of machine speeds, tool life and production costs. These men demanded proof and got it.

SPEEDS INCREASED UP TO 400%

Lusol affords such efficient cooling at the point of tool contact that it has made possible up to 300% to 400% greater speeds, and at the same time less tool wear, less tool breakage, finer finish and greatly increased production. One case, for example, a bar of 18.8 stainless steel was being cut in 20 minutes. Lusol was then used. Speeds were increased from 30 RPM to 267 RPM and the bar was cut in 2 minutes. On this job tools had been breaking frequently. After shifting to Lusol, tool breakage has been reduced to zero. This is just one case, but it is typical of the results that make Lusol hard to compete with.

WHY OPERATORS LIKE LUSOL

Lusol offers the operator many advantages. In the first place it is clear and clean, mild as a soap solution, and not irritating to the skin. Clothes and shoes are kept cleaner and the whole shop takes on a new look. It helps keeps the machine clean, and a good operator appreciates this; and, very important, it is a clear solution that allows the operator to see the work as the finest drill comes down to the work piece. This means more perfect vision at the critical point so often blurred by old type coolants. On top of being pleasanter and easier to work with, Lusol means fewer tool changes, less wheel dressing, far greater speeds, and more efficient production.

SAVINGS YOU CAN'T AFFORD TO MISS

If you are machining, milling, boring, broaching, tapping, drilling or grinding, you cannot afford to disregard the savings that Lusol has made possible for others (perhaps your competitors) whose production involves these operations. Look at these figures "275% greater production per broach grind," "Saved 90% drills, 75% taps," "Over 200% more pieces per wheel dressing." These are facts. They are proof of the type of result Lusol is achieving and can achieve for you.

PROOF THROUGH CASE HISTORIES

BROACHING

266% greater production per broach grind

AMERICAN HORIZONTAL BROACH
Metal: Steel forging
Operation: Broach clutch hub. Broach and work ran hot requiring a *shutdown every 2 hours* for cooling when ordinary cutting oil was used. Changed to Lusol and ran 8 hrs. continuously. Tool and work remained cool.
Ordinary Cutting Oil — 2100 pieces per broach grind.
Lusol — 7700 pieces per broach grind.

TAPPING

Tap life increased 1300%

LEES SPECIAL TAPPER
Metal: No. 1008 Steel.
Operation: Tap ¾" — No. 11 1" through an 11/16" drawn hole at 120 SFPM.
Ordinary Cutting Oil: 30 pieces per tap.
Lusol: 420 pieces per tap.

GRINDING OPERATIONS

Grinding time reduced 25%

LANDIS EXTERNAL GRINDER
Metal: CN Steel.
Operation: Step roll grind to 4 diameters, 1.6" r, 1.9" r, 2 rt. angles removing .015"-.030" of metal.
Ordinary Soluble Oil: Grinding time 8 hours.
Lusol: Grinding time 6 hours.

CASE HISTORIES YOU CAN'T AFFORD TO OVERLOOK

Lusol

SAVES TOOLS ▼ SPEEDS WORK CUTS COST

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☐ Broaching ☐ Drilling, Tapping ☐ Grinding

Name

Company

Address

countered in any plant, each requiring a specific chemical, physical, or mechanical action in its removal. The well-balanced cleaning solution will provide just the right amount of each type of action for the work involved. Selecting a cleaning solution without a survey to establish cleaning requirements is like buying a pair of shoes without trying them on. They may be the right length and width, but are liable to pinch in spots.

The purpose of this article is solely to note the importance of balancing the cleaning action of a metal cleaning solution to the type of work involved, while at the same time retaining, insofar as possible, other desirable cleaner properties. This is but a single factor in a composite cleaning setup, but an important factor to say the least.

For further information on any product mentioned in this issue—use the READER SERVICE CARDS between the covers.

with

"YANKEE"

Spiral Ratchet Screw Drivers

With the fast, easy action of "YANKEE" Spiral Ratchet Screw Drivers, tough assembly jobs are a pushover. Used on thousands of applications like the one pictured above "YANKEE" Drivers speed work, cut costs on every unit—keep worker fatigue at a minimum. Made in two styles—regular and "quick-return". Accessories available for a variety of uses.

FREE →

See how "YANKEE" Spiral Ratchet Screw Drivers are proving their value in speeding assembly on everything from baby strollers to oil burners. Write to North Bros., 231 West Lehigh Avenue, Philadelphia 33, Pa.

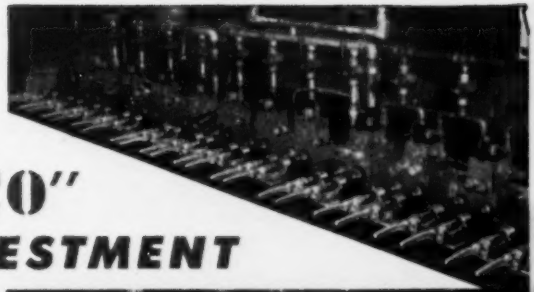
Ask your Industrial Distributor to show you the complete line of "YANKEE" time-saving tools.

"YANKEE" TOOLS NOW PART OF
STANLEY
THE TOOL BOX OF THE WORLD
NORTH BROS. MFG. CO.
Philadelphia 33, Pa.

"You the guy that was yapping for bar stock?"

$100

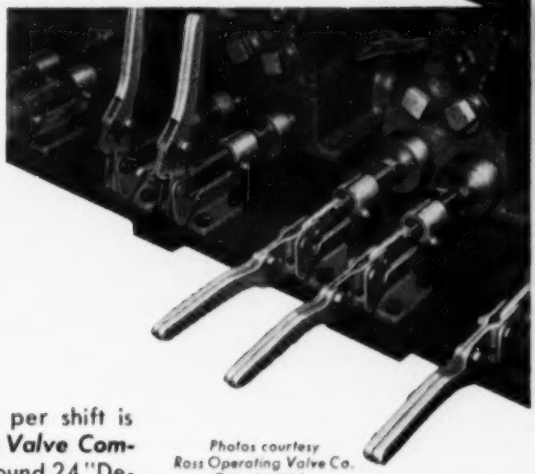
"DE-STA-CO" CLAMP INVESTMENT



saves over

$5000

each shift per year



A saving of 12 man-hours per shift is reported by ***Ross Operating Valve Company*** with this fixture, built around 24 "De-Sta-Co" Model #620 Toggle Clamps.

Photos courtesy Ross Operating Valve Co. Detroit, Mich.

The fixture holds ***Ross*** 4-Way air operating valves during a "run-in" operation. The clamp plungers are tipped with rubber grommets which seal exhaust and intake ports during the "run-in," after which the valves are torn down and inspected carefully. Besides the actual saving in man-hours, these "De-Sta-Co" Toggle Clamps convert a tedious setup job into one quickly and accurately performed by less highly-skilled labor.

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Reducing The Cost of Permanent Tooling

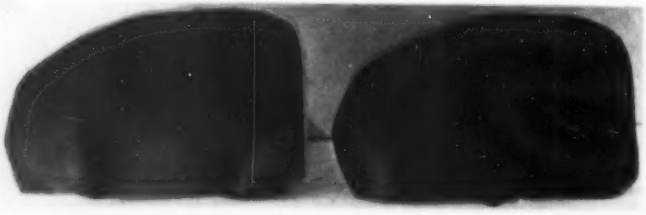
The author discusses techniques for obtaining permanent production molds and dies at costs which are comparable to expenditures normally made for temporary tooling.

By Frank Charity

A NEW method of fabricating tools currently enables western aircraft manufacturers to obtain permanent production molds and dies at costs which are comparable to the expenditures normally made for temporary tooling. The method consists, briefly, of producing a metallic cavity or shell on a low-melt thermoplastic pattern and separating the shell from its pattern so that the metallic impression can be reinforced for production usage. The new process can be distinguished to the extent that it permits the buildup of tooling impressions with the most desirable physical characteristics in a reasonably-short period of time on inexpensive patterns of the type that would normally be susceptible to heat-damage at comparatively low temperatures.

Virtually all types of metallic and non-metallic pattern materials could be used for the subject work, however, a low-melt thermoplast is preferred for economic reasons. The latter material is a tough wax-like substance at room temperature, can be heat-softened and hand-worked like putty or moist modeling clay at temperatures of about 125 deg. F., may be completely melted and cast without defects at temperatures exceeding 150 deg. F., and has a flash point of about 600 deg. Fahrenheit.

The pattern material is usually cast in a form with the approximate dimensions that will be required for a specific pattern. For example, four metal bars on a flat table top can pro-



Patterns for the fabrication of stamping molds for sheet stock, as indicated here, have been quickly made by hand-pressing heat-softened thermoplastic sheets to the contours of plaster mockups.

A low - melt thermoplastic pattern (lower center) and a master mold (lower right). The master mold was made by casting Hydrocal on the pattern, which permits duplication of the pattern whenever necessary.

vide a cavity for casting rough sheet patterns.

Rough patterns are heat-softened, if necessary, by immersion in warm water, after which the general contours of a finished pattern can be hand-formed. Standard cutting tools are used to carve or machine final details on the pattern at room temperature. Bad cuts or mistakes made in producing the final details on a pattern can be quickly repaired by fusing in the defective areas with a soldering iron so that accurate details can be substituted.

Where plaster mockups were available, patterns for stamping tools have been prepared with unprecedented speed and ease by hand-pressing heat-softened thermoplastic sheets over the mockup surfaces.

At temperatures of less than 110 deg. F., thermoplastic patterns can retain details of extreme dimensional accuracy for an unlimited period of time. Therefore, if it is strip-coated without heat, each pattern may be used to make a sequence of mold or die impressions with the accuracy essential to mass-production interchangeability.

Two different processes have been developed for the application of metallic strip coatings without heat to thermoplastic patterns. One is fundamentally an electroforming process, while the other is a vacuum-metallizing technique.

The electroforming method, as recently developed by Warren Plating Company of Los Angeles, consists of conductively coating the pattern surfaces with a chemical-reduction solution (of the type used in "silvering" mirrors) so that a metallic impression can be built up on the pattern surfaces in an electroplating tank. Impressions thus formed can be stripped from the patterns without difficulty and strongly reinforced with cast alloys. However, since the conductive coatings are not permanent constituents of the

A soldering iron can be used, as shown here, to fuse-in defects or to assemble the components of low-melt thermoplastic patterns.

metallic impressions, there is a slight loss of dimensional accuracy in the resultant tools; and, since many useful types of alloys cannot be deposited via electrolytic solutions, it is usually impractical to electroform impressions with optimum qualifications for permanent tooling.

Vacuum-metallizing techniques are comparatively expensive, but have been used to create high quality tooling impressions with great speed. Development of these techniques to a current state of commercial usefulness is generally attributed to work accomplished by Dr. John Strong at California Institute of Technology. These techniques comprise: (1) cathode sputtering—a method of using high-voltage electricity to disintegrate a cathode, so that the metallic constituents of the latter will be deposited on an anode-supported surface in a vacuum chamber; (2) evaporation coating—a method of using high amperage current to heat-vaporize a metal or similar material, much the same as water is heated to produce steam, so that molecular particles of the vaporized material can be deposit-

Pictured: a 24-Spindle Heavy-Duty Drill Head.

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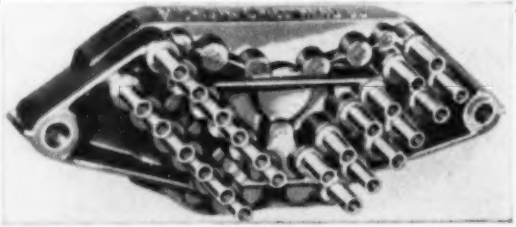

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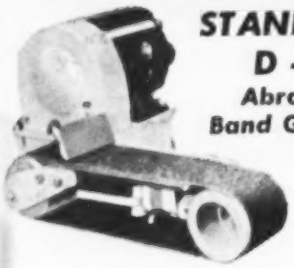

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ed on either a metallic or non-metallic surface in a vacuum chamber.

Both techniques involve the use of a vacuum chamber because their effectiveness usually depends on the removal of air and the substitution of an

Molds comprising metallized cavities reinforced with cast alloys are accurate, almost as inexpensive as temporary tooling, and as permanent for many production jobs as the most expensive types of tool-steel molds.

inert gas (such as argon or helium) to prevent the oxidization of deposition materials. However, the evaporation method is regarded as the most suitable for tooling purposes and is probably the only vacuum-metallizing technique for which commercial equipment is now being produced.

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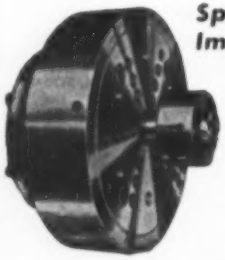
Details such as gates and sprues are machined on molds comprising metallized cavities reinforced with cast alloys.

very little heat to deposition surfaces, evaporation coating is a highly regarded process because its deposits may be dimensionally accurate within tolerances as small as a millionth of an inch and because evaporated metals may have the most desirable physical properties, including low porosity, maximum ductility, and enough smoothness to eliminate the need for most finishing operations.

Manufacturers of evaporation equipment now include E. J. Stokes Machine Co., Philadelphia; National Research Corp., Cambridge, Mass.; and Distillation Products, Inc., Rochester, New York.

Alternating current from factory power lines, transformed for output values of 1 to 135 volts and 5 to 400 amperes, is used to heat a tungsten coil or crucible containing the metals used in evaporation-coating work. Coils are used as crucibles because surface



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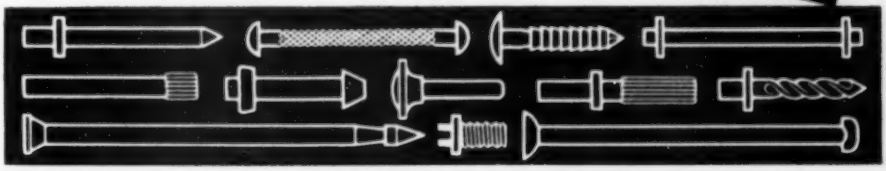

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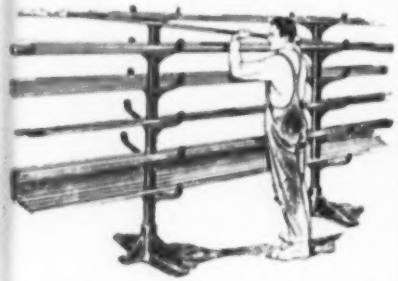

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tension will usually prevent the flow of materials therefrom at molten temperatures.

Intra-chamber pressures for evaporation work normally range from 1 x 10^{-4} to 5 x 10^{-5} mm. Hg. after air is evacuated and an inert atmosphere is substituted, and a radiation baffle is normally used to concentrate the vapor output of a heating element for deposition on the surfaces of a thermoplastic pattern, which is usually suspended by means of a fixture over the heating element.

Typical evaporation materials and their absolute vaporization temperatures at 10^{-3} Hg. include:

Materials	Temperatures
Cadmium	541
Zinc	623
Magnesium	712
Barium	905
Chromium	1190
Aluminum	1461
Copper	1542
Iron	1694
Nickel	1717
Molybdenum	2755
Carbon	2795

Although elements alone are indicated above, many alloys can be used for evaporation purposes; and, in any event, the depth of an evaporation coating is directly proportional to the number of minutes and seconds during which metals are vaporized.

Transparent evaporation coatings with depths or thicknesses of less than ten millionths of an inch have been permanently applied to photographic lenses, and so on, to improve the ability of the latter to transmit light without reflections. However, opaque metal coatings are built up on patterns for

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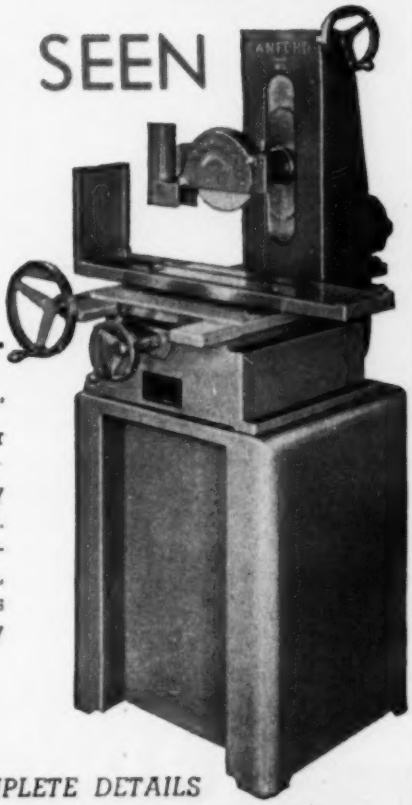

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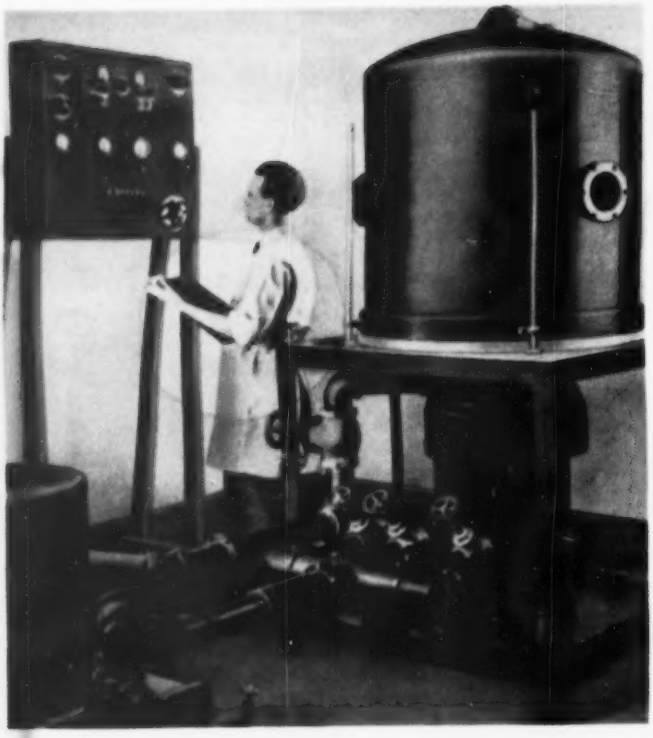

Illustration showing an evaporation coating unit of the type used in making durable, accurate mold or die impressions on low-melt thermoplastic patterns.

tooling purposes.

It is possible to build up an opaque evaporation coating over a surface area of more than 3000 square feet with no more than an ounce of metal; and, in some circumstances, such coatings on tooling patterns have been reinforced by electroform electroforming metal spraying, and so on, prior to separation from the patterns. However, experienced engineers are now inclined to agree that the best procedure is to build up an evaporated-metal impression with a thickness of 1/64 inch or more, if the best possible tooling should be produced with minimum effort.

The adhesion of evaporation coatings to low-melt thermoplastic surfaces is relatively slight, but it is very difficult to separate the metal and plastic materials without damage when the former are too thin to be ab-

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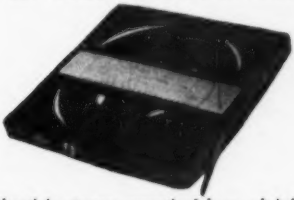

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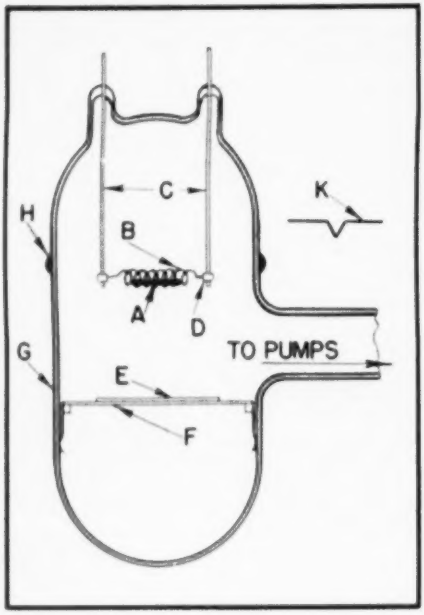
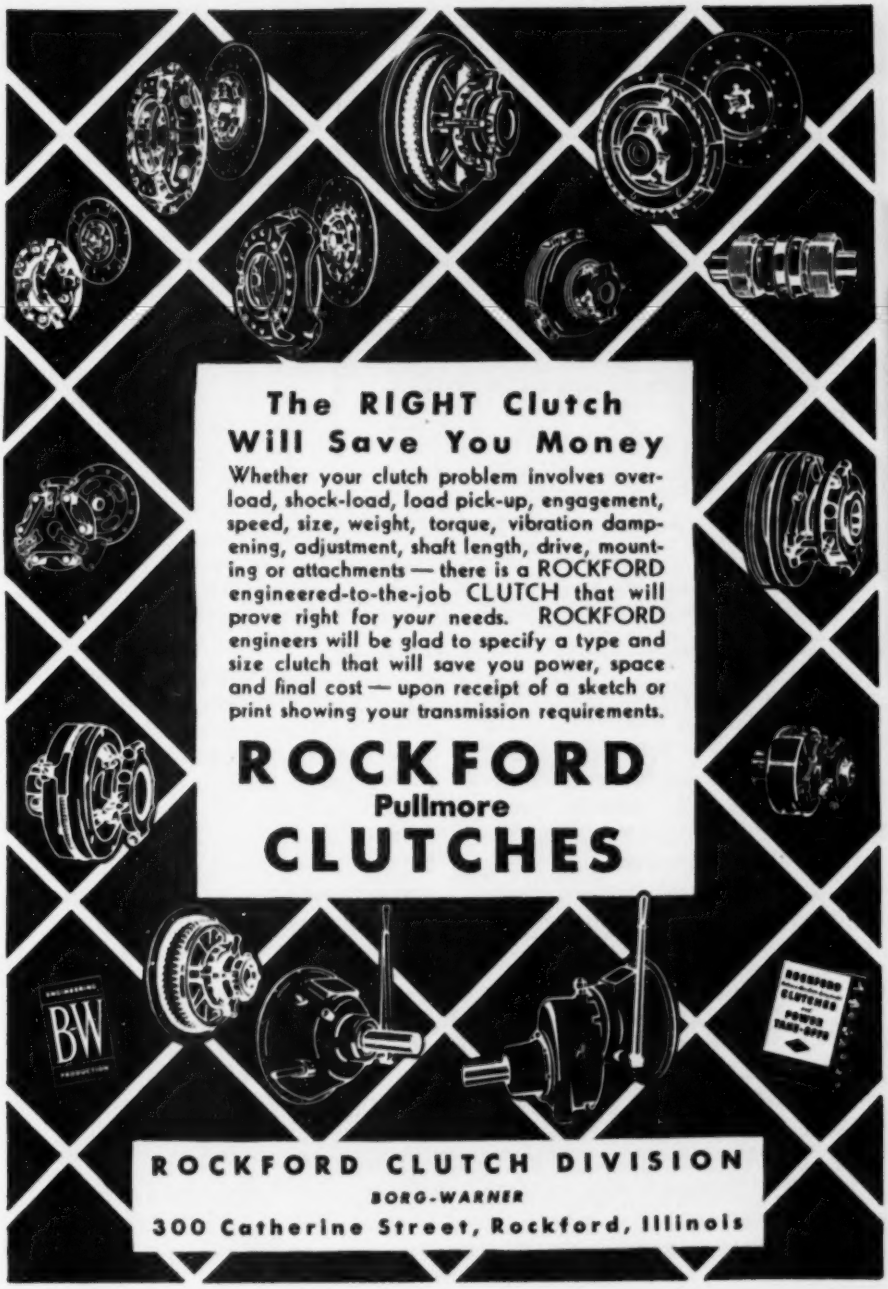
solutely rigid; and, as a rule, it is easier to build up a rigid impression in an evaporation chamber then to reinforce a thin coating with a secondary metallizing operation.

After they are stripped from thermoplastic pattern surfaces, metal



Schematic details of an evaporation-metallizing unit: (A) Evaporation material, (B) Tungsten-coil crucible, (C) Electric power lines, (D) Iron supports for crucible, (E) Surface to be metallized, (F) Fixture supporting the latter surface, (G) Vacuum-chamber wall, (H) Seal at point where vacuum chamber is opened and closed. An alternate type of tungsten crucible is designated by the letter "K".

tooling impressions are usually backed up with molding sand for reinforcement with cast alloys. Cavities for the reinforcing alloys frequently comprise sand retained in conventional wood flasks, but higher tooling strength has been attained by placing the metal impressions in welded-steel retainers so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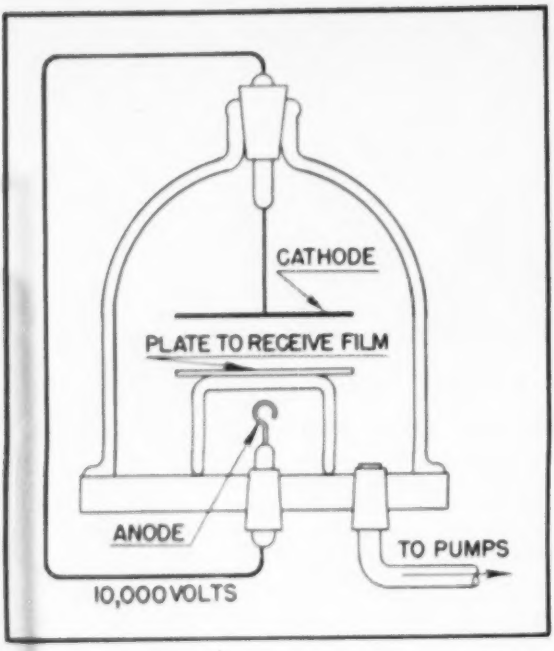

Schematic details of setup used in cathode sputtering.

that the latter would comprise the outer mold walls after reinforcing metals were cast therein. Pressure, centrifugal, and vibrational techniques have been employed in various circumstances to improve the homogeneity of cast-metal reinforcements.

It would, of course, be inaccurate to say that molds or dies thus produced are as strong and durable as tooling machined from the finest grades of tool steel; but, for a considerable number of production purposes, they are as permanent from the practical viewpoint as the most expensive tools. For example, in drophammer work where temporary dies worth $1000 a pair would have to be replaced at least one time to complete a production run and where the only alternate tools would be machined-steel dies worth $10,000 a pair, mated tools of the subject type have been fabricated for about $1500 and used to complete a production run without replacements.

Similarly, in presswork where steel molds worth $35,000 and capable of producing more than 10,000,000 parts would ordinarily be used, the subject type of tooling has been satisfactorily fabricated at a cost of $2500 for the production of 1,000,000 parts.

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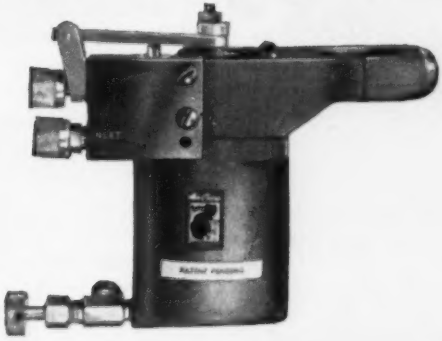

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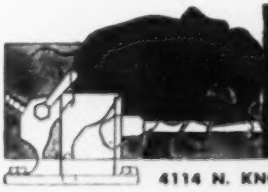

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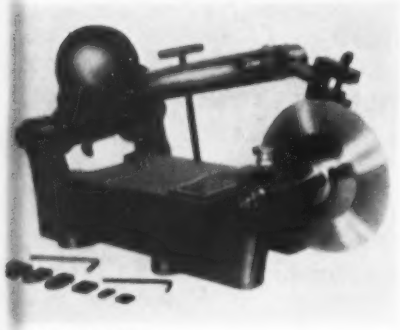

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ing requires special machine work after metallized impression shells have been reinforced. For instance, details such as gates and sprues must be machined on the tools used in die-casting operations. However, the amount and cost of such work are invariably less than could be anticipated in the fabrication of tooling with comparable potentialities.

If regarded in terms of production capabilities alone, the new tools are analogous to hobbed cavities. However, hobbed cavities have a number of well-known design limitations and their fabrication requires the use of expensive tool-steel patterns, the cost of which could be amortized, comparatively speaking, only where it is necessary to duplicate a large number of tools in a relatively-short period of time.

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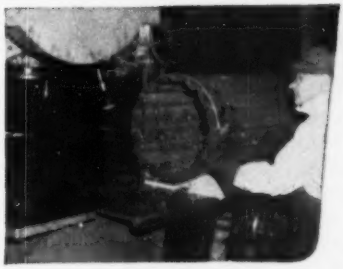

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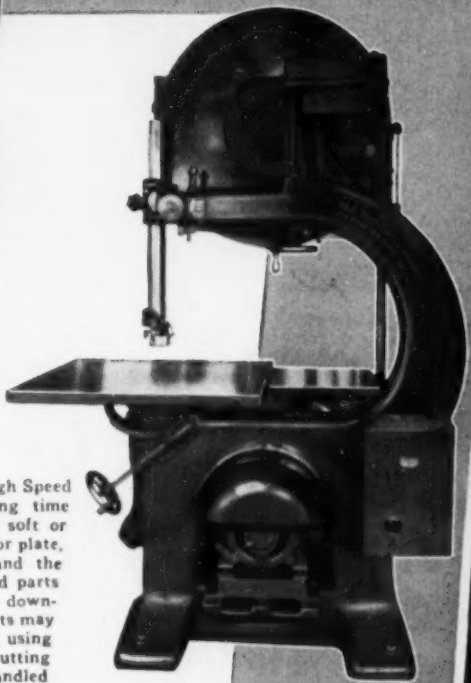

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with **Tannewitz**

HIGH SPEED BAND SAWS

Want to reduce your TAP BILL 50%? 59%? — even 75%?

BLAKE TAP SHARPENING EQUIPMENT DOES THIS FOR OTHERS

No 1. in a continuing study of tap performance records made by users of Blake Tap Sharpening Equipment.

TAP PERFORMANCE

Before Sharpening Average standard Commercial Grd. ¼-28 tap cutting ⅛" deep through hole in copper. Total holes per tap—3700.

After Sharpening on Blake Equipment Tap reground with 18° hook in both flute and spiral point increases average holes *per grind* to 22,500—an increase of over *600% per grind*. Average six grind per tap before it is discarded as too small or too short in thread length. Total holes per tap—135,000.

Why Not You!

To get dollar-for-dollar value from your taps, you *must* sharpen them just as you do other cutting tools. The Blake Flute Grinder and the Blake Chamfer Grinder provide you with fast, accurate, and economical means for grinding straight flutes, spiral points, and the chamfered ends of your taps — a sure means of reducing your tap bill. Investigate today.

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TORIT DUST COLLECTORS

There's danger in hockey, and danger in industrial dusts. Like sharp hockey skates, the dusts in your plant can cut and scratch, damaging expensive machinery and finished parts. They affect employees' health, and are a direct cause of excessive labor turn-over.

A Torit Dust Collector can be the perfect goalie for your cut-off, polishing and grinding machines. It stops all shots, and recirculates the cleaned air. Furthermore, this goalie stays in the game, requiring a minimum of attention and maintenance.

Torit Dust Collectors are compact and self-contained. There are sizes for all standard applications, and special set-ups can be quickly fabricated. For details and the latest Torit catalog, write:

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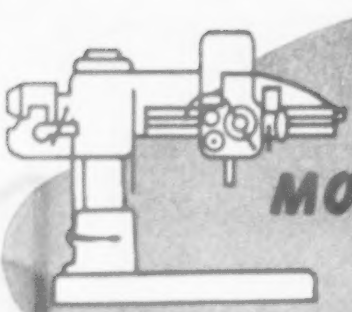
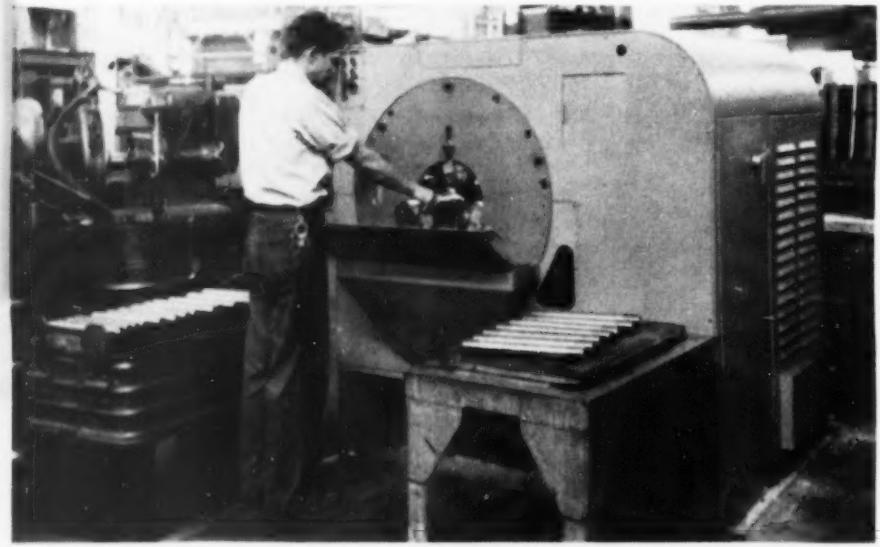


MODERN EQUIPMENT AT WORK

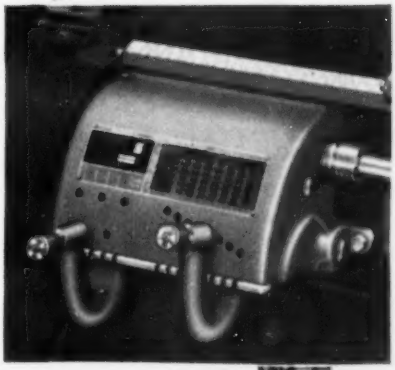
Rolling Threads on Diesel Locomotive Engine Parts

THE Eddystone Division Shops of The Baldwin Locomotive Works recently installed a Reed A32 cylindrical die thread roller for rolling Class 5 threads up to 1⅝ inches in diameter on cylinder head studs and connecting rods used in Diesel locomotive engines. It is claimed that manufacturing savings with the thread roller have amounted to over 50 per cent of the total cost of the bolts and studs. These savings have been made possible, on the studs, by the rolling of the threads using ground bar stock of diameters smaller than previously used and elim-



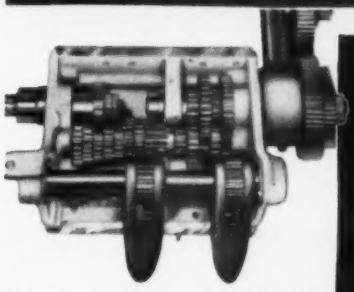
Cylindrical die thread roller is used to produce Class 5 threads on Diesel locomotive engine parts in the Eddystone Division Shops of The Baldwin Locomotive Works.

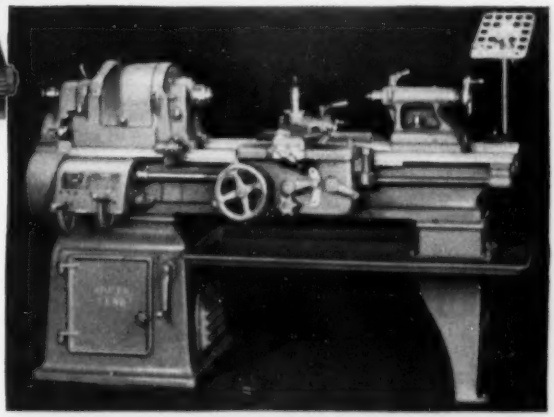
IMPROVED SOUTH BEND QUICK CHANGE GEAR MECHANISM *Saves Time*



A new and simplified quick change gear mechanism is now supplied on South Bend 16" Precision Toolroom Lathes. It has been designed to save you time and provide long, dependable service.

A direct-reading index chart shows the settings of the two control levers for power feeds and screw threads. Changing from roughing to finishing feeds requires moving only one lever—no clutches or primary sliding gears to change. Special intermediate gearing for metric, worm or other unusual threads supplied to order. All gears and shafts are precision machined.





16" x 6' Precision Toolroom Lathe with 8 speed drive, f.o.b. factory **$2538.00**

Price includes standard toolroom attachments; drum switch and 1½ h. p., 220 V., 3 ph., 60 cycle motor.

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inating the undercutting of the portion of the stud between the threads. Connecting rod bolts were redesigned for rolling with costs reduced as much as 67 per cent.

Threads are produced with a high degree of surface finish, providing greater contact of the external thread with the mating part. Pitch diameter tolerances are said to be easily held due to the accurate thread form, lead, taper, and roundness provided by the thread rolling process. Subjected to high stresses, the threads must be strong and of maximum quality and held to rigid inspection requirements. The uniformity with which these exacting tolerances are maintained is said to ensure an accurate fit of each stud in the cylinder block and considerably reduce inspection and assembly costs.

Automatic Press Used to Assemble Valve Guides

ONE of eight major machines recently installed in an entirely new cylinder head production line for Willys-Overland Hurricane F-Head engines is the completely automatic 15-ton Colonial assembly press shown in Fig. 1, which is designed to press valve guides into place four at a time. Fig. 2 shows the lower side of a casting without guides (left) and the upper side of a casting with guides in place (right).

The six-step automatic operating cycle provided by the three-station machine is as follows: (1) The cylinder head is loaded in station 1 between the guide rails and is backed against an approximate stop; (2) the head is transferred to station 2 where it is located automatically; (3)

BARKER

(Two-Jaw or Three-Jaw)

WRENCHLESS CHUCK

will pay for itself in 60 to 90 days on production schedules by giving MORE parts per hour at a LOWER cost per part. Most round parts can be set in the Barker Wrenchless Chuck without stopping the machine. It saves time, helps speed up production, and cuts spoilage where the run is continuous on turrets, engine lathes, cutting off machines, drill presses or any other type of chucking machine. The Barker Chuck shown here, replacing an ordinary 3-jaw chuck, jumped production from 18 to 24 pieces per hour. It can do it in *your* plant too. Let us show you how!

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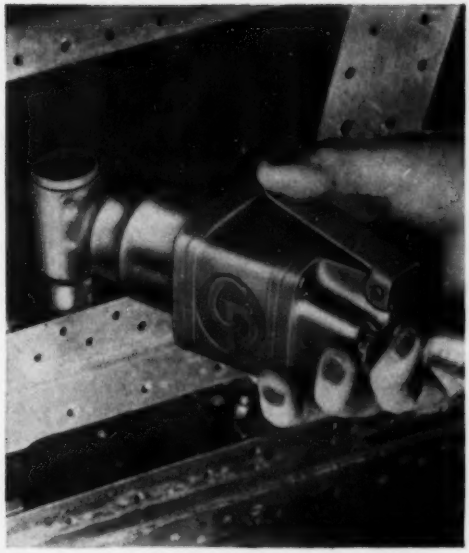
Chuck Division

THOMAS HOIST CO.

28 S. HOYNE **CHICAGO 12**

Compactness of CP-337 with 90° angle head speeds assembly work where nuts are hard to reach.



45° angle head on this CP-344 permits quick and easy location of socket on 5/16" frame bracket bolts.

for faster and easier bolt and nut running

Capacities—Bolt Size	
CP-337	¼"
CP-344	⅜"
CP-3440	⅜", heavy duty
CP-349	⅝"
CP-360	¾"
CP-3630	¾", heavy duty
CP-365	1¼"

— on production lines, and in maintenance work — reversible CP AIR IMPACT WRENCHES speed operations, cut costs. There's no twisting thrust to fatigue operator.

Complete line from CP-337 (¼" bolt size) to CP-365 (1¼" bolt size) meets every requirement. The only complete line of impact wrenches with angle heads available in all sizes to reach awkwardly located nuts, bolts or studs.

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TROYKE MFG. CO.
Cincinnati 9, Ohio, U. S. A.

brushes move up from below, cleaning out the valve guide holes in the casting and leaving an oil film to lubricate the guides as they are pressed into place; (4) a shuttle feeds four valve guides from a tube-loaded hopper and move them out over the top of the cylinder head directly under the

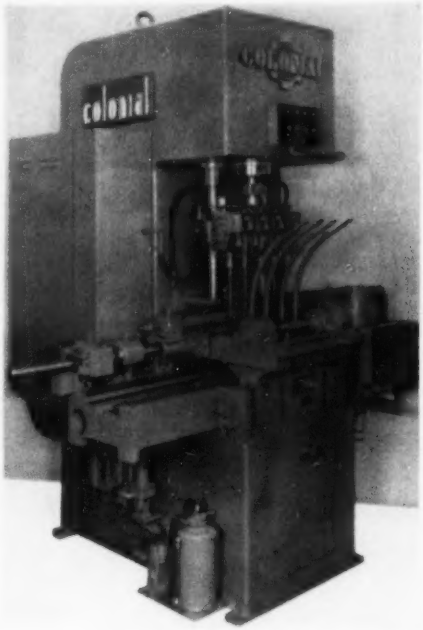
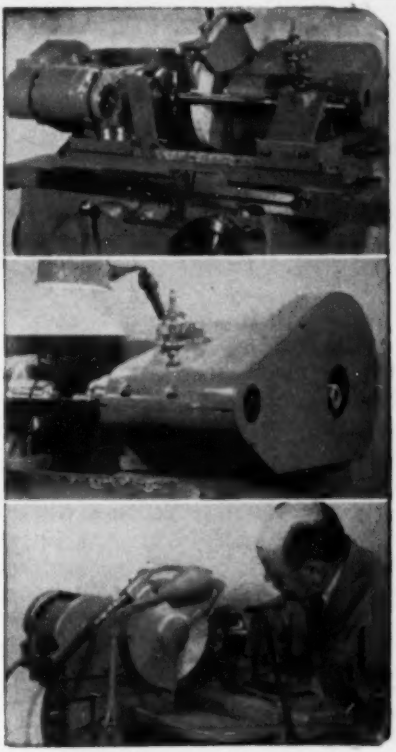


Fig. 1—This special 15-ton assembly press in use on the Willys-Overland F-Head Hurricane engine line is designed to automatically receive and locate cylinder head castings, clean and lubricate valve guide holes, press in four guides at a time, and eject the finished head.

plungers; (5) as the ram moves downward, four stepped plungers enter the bores of the guides and press them into the casting; (6) the ram returns to its uppermost position, the shuttle returns to the hopper for more guides, the next cylinder head is automatically moved into position, ejecting the finished part to station 3 and then



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MODEL No. 103

A relatively low-priced machine for cylindrical, internal, end or surface grinding.

The ARTER Model No. 103 grinder can be purchased as a combination machine for the classes of work illustrated, or it can be purchased just for cylindrical jobs, or for internal work. Many of these machines are being used for tool room work or as auxiliary equipment to take the overload of higher priced machines.

Capacities: With internal head—1/8" to 3" dia. x 4" long. With external head—3" dia. x 10" long. Swing over table 9".

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GRINDING MACHINE CO.
WORCESTER, MASSACHUSETTS • U. S. A.

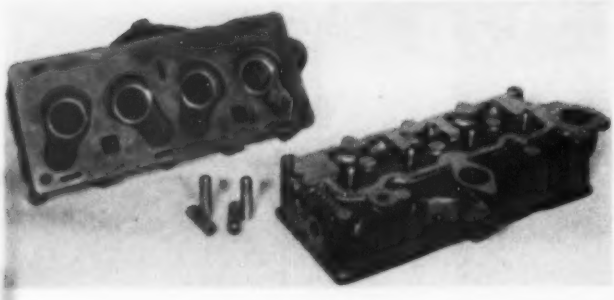

Fig. 2—The lower side of a cylinder head casting is shown at the left before guides (center) have been pressed in place. The top side of a head with guides in place is shown at the right.

transferring them onto a conveyor.

Automatic inspection is also provided by the machine since it is equipped with pressure switches which interrupt the cycle if any one of the four pressed fits is either too tight or too loose. Signal lights at the top of the machine indicate the trouble and show directly which guide is defective, thereby enabling the machine operator to remedy the difficulty with minimum down-time. In addition to improved quality control, the inspection system also prevents damage to the machine or to the head castings.

Adjustable-Speed Motor Aids Milling Operation in Steel Plant

A GENERAL ELECTRIC Type ACA motor has solved the problem of providing the many different

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...grinds straight flutes from solid... automatically

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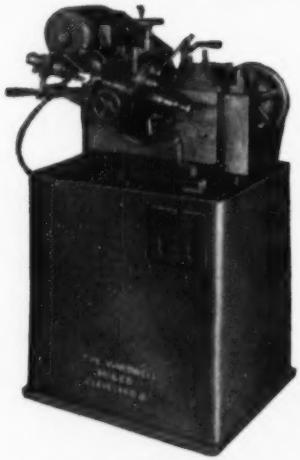
Grinds wet or dry . . . write for Bulletin 50F Automatic Universal Flute Grinder.



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Yes, the "holes" in our engineers' heads are full of ideas to give you newer, faster, lower cost methods of boring . . . methods that save you time and money. If your job needs a special bar or special cutter, we'll design and make it. Chances are a standard Madison cutter in the right Madison bar will give you greater production economy. The Madison line, built over a period of thirty-five years, is broad enough to fit nearly any boring requirement. Let Madison's experienced boring specialists . . . the "men with holes in their heads" . . . help you cut your boring costs. Submit your problems for recommendations by our problem solving tool design department. Of course there's no obligation.

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An adjustable-speed induction motor is used to drive this corrugating machine that is designed to mill deformations in grooves of rolls which produce deformed concrete reinforcing bars.

exact speeds required by a milling machine at the Judson Steel Corporation plant in Oakland, California. The machine is used to mill deformations on rolls used in a corrugating machine. The hot metal passes under the rolls which form the familiar ridges or elevations found on these bars.

According to Judson engineers, the adjustable-speed a.c. motor has shortened the length of time required to prepare the rolls for the bar processing. The deformations in the grooves vary in depth and number, depending upon the size and type of bar to be rolled. Therefore, it is necessary to adjust the speed of the revolving cutting head constantly according to the size of the deformation being cut. With the adjustable-speed motor, it is possible to make such adjustments in speed quickly and accurately, thus reducing time required for the milling operation.

Besides cutting deformations on new rolls, the machine is also used to clean the deformations on old rolls. The depressions on the grooves of the rolls become filled with foreign matter through use, making it necessary to re-mill them for continued accuracy in the processing of the concrete reinforcing bars.

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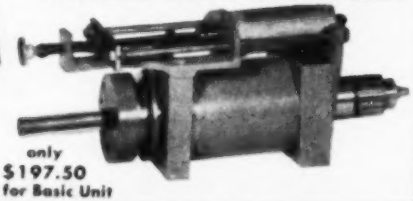

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Best buy in 15" drill presses. Complete line of single and multiple spindle models, bench and floor types. Many exclusive Famco features.

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In 3 power and 5 foot models. Cutting widths 22" to 52". Capacity up to 18 gauge mild steel. Inexpensive, ruggedly built, many features.

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We invite you to check your needs against the Famco Line, shown above, then write for catalogs on the products in which you are interested. There is no obligation.

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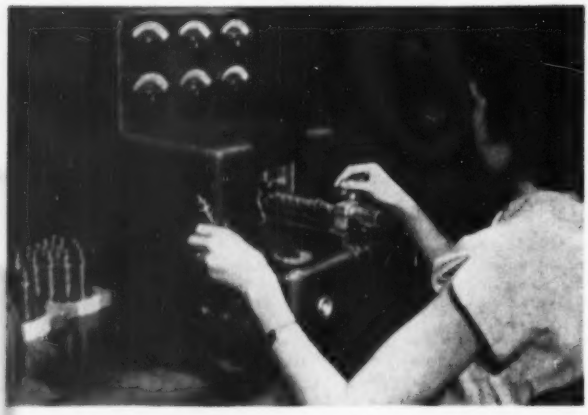

Illustration showing operator using a multiple station gage to check eccentric shafts for taper, throw, concentricity, and diameters

Gage Permits Checking of 300 Eccentric Shafts per Hour

ALL critical dimensions of a precision eccentric shaft are checked simultaneously at a rate of 300 parts per hour on the specially designed Pratt & Whitney Electrolimit Gage shown in the accompanying illustration. One semi-skilled operator inspects diameters, bearing concentricity, bearing taper, and throw of eccentric in a single operation. Formerly, the various tolerances were checked on individual Electrolimit gages.

Gaging is completely automatic so that the operator merely loads the work, notes the dial readings, and un-

How SQUARE HOLED SLEEVES SPEED UP TOOL-MAKING!

One of the most difficult problems in tool making can be solved easily and quickly with Sturdy Square Holed Sleeves. The perfection of broached square holes can be had in boring bars, milling cutters and many other applications at a small fraction of the cost of imperfect hand-made square holes. The Sturdy Square Holed Sleeve consists of a round sleeve with a perfectly square hole broached through the center. This hole is tapped at one end to receive a back-up screw which is furnished with the Sleeve. The Sleeve can be sweated or pressed into a drilled and reamed hole to make a perfectly square accurate hole in a very few minutes.

The Sturdy Square Holed Sleeve will save you many hours and many dollars in the making of boring bars, tool holders and other tools requiring square holes.

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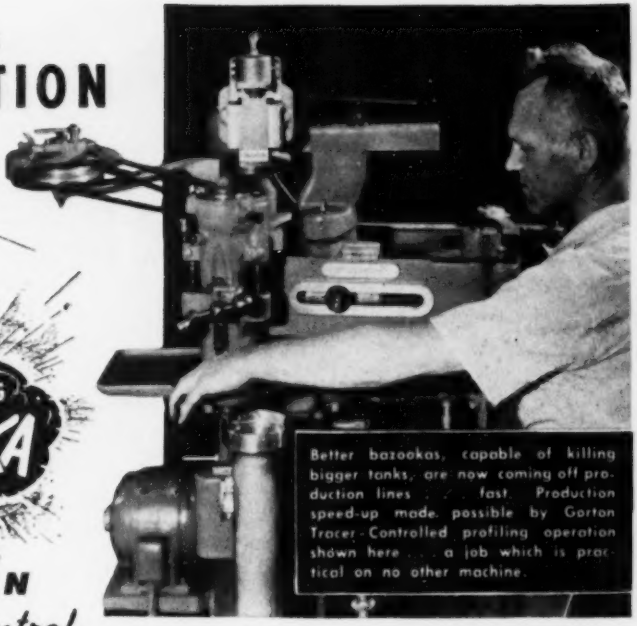

Better bazookas, capable of killing bigger tanks, are now coming off production lines . . . fast. Production speed-up made possible by Gorton Tracer-Controlled profiling operation shown here . . . a job which is practical on no other machine.

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• SPEEDS PRODUCTION • CUTS COSTS

On many all-but-impossible jobs, Gorton Tracer-Controlled Pantographs and Duplicators speed up production on military or industrial contracts. High surface finish results from spindle speeds up to 45,000 R.P.M. Accuracy results from the use of over-size masters, patterns, or templates together with the reduction ratio which is exclusively characteristic of the pantograph. Whether a dozen or a thousand pieces, each is identical to the first. Work piece size varies from instrument parts to areas of 10 to 20 feet.

Gorton tracer-controlled equipment quickly pays for itself in profiling, routing, die sinking, mold cutting, counterboring, chamfering, grooving, graduating, engraving as well as many other standard or special operations on ferrous or non-ferrous metals and plastics where work is flat, uniformly curved, cylindrical, spherical or irregular in shape.

Mail the coupon below for General Catalog illustrating the complete Gorton line.

PRODUCTION DATA—

JOB: Profile 6 locking lugs for male and female sections of new 3.5" Bazooka
MATERIAL: Aluminum alloy
CUTTER: 5/32" dia. single flute, fast spiral H.S. steel running at 3,900 R.P.M., without coolant
MASTER: 2 masters: one for male and one for female sections; 3 times oversize, traced manually
HOLDING FIXTURE: Pneumatic-operated internal expanding type
APPROX. TIME: 36 pieces per hour
ALTERNATE METHODS: None practical

Please send at once complete information about the Gorton line contained in Bulletin **1655-1701.**

Firm .....
Name .....
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Fig. 1—Two-spindle automatic rotary surface grinder with special fixture for grinding sides of connecting rods

loads the work. To check a shaft, the operator places it in a cradle at the front of the gage and presses a button. The part is automatically conveyed to gaging position where it is rotated by an electric motor between contact fingers on the gage, thus actuating the dials, which are calibrated in hundred-thousandths of an inch. Limit hands show at a glance whether the parts are within tolerance. When the operator has completed the readings, the button is released and the shaft is automatically ejected from the gage.

Grinding Sides of Connecting Rods

EQUIPPED with a special fixture for grinding the sides of connecting rods, the two-spindle automatic rotary surface grinder shown in Fig. 1 has been recently completed by Mattison Machine Works and shipped to one of the automotive companies. With the machine, workpieces are first rough ground by a coarse grained wheel mounted on one of the spindles of the unit, after which they are checked by means of an automatic sizer. The workpieces are then passed under a fine grained wheel mounted on the

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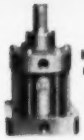
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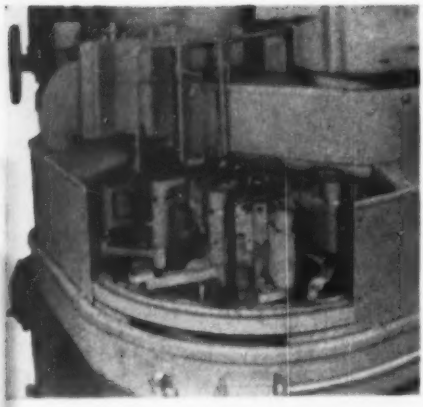

Fig. 2—Close-up view showing special fixture for holding connecting rods during grinding of the sides

other spindle of the machine for the finish cut and again checked by an automatic sizer before being released from the work-holding fixture.

Fig. 2 is a close-up view of the two-spindle automatic rotary surface grinder, showing the special fixture used in holding the connecting rods as they are passed through the machine for grinding the sides.

High Speed Automatic Press Equipment Used to Produce Toggle Switch Parts

BECAUSE of their labor-saving and production - increasing features, high speed automatic presses are now widely used in different types of plants for producing a variety of metal parts. One particular plant, for example, has made use of a Diebel 12-ton high speed automatic press with built-in roll feed to produce metal stampings for toggle switches. The material employed in the manufacture

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SHARPENS ALL SMALL GAUGE & FRACTIONAL DRILLS

QUICKLY • AUTOMATICALLY • ACCURATELY • AT 50% SAVINGS

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They produce quantities of perfectly sharpened small drills, with lips of uniform length, correct angle and proper clearance for true, accurate drilling. They also release skilled mechanics for more important work—because anyone can operate a Black Diamond.

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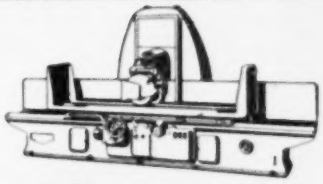
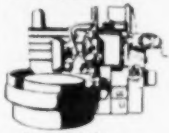
For catalog on all machines, ask for free copy of general bulletin.



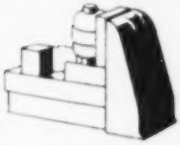
Precision Surface Grinders Horizontal Spindle

Disc Grinders, Double Spindle Type

Vertical Spindle Disc Grinders

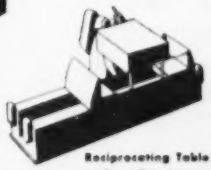


Plano Grinders, Rotary Table Type



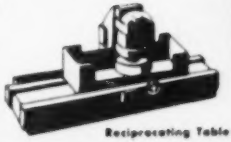
Rotary Table Surface Grinders

Automatic Rotary Surface Grinders



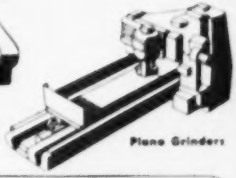
Reciprocating Table Face Grinders

Disc Grinders, Single Spindle Type



Reciprocating Table Surface Grinders Vertical Spindle

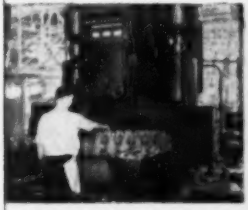
Face Grinders, Traveling Wheel



Plano Grinders

40 hours before — now 4 hours. Pump seat ground on Mattison Horizontal Spindle Precision Surface Grinder

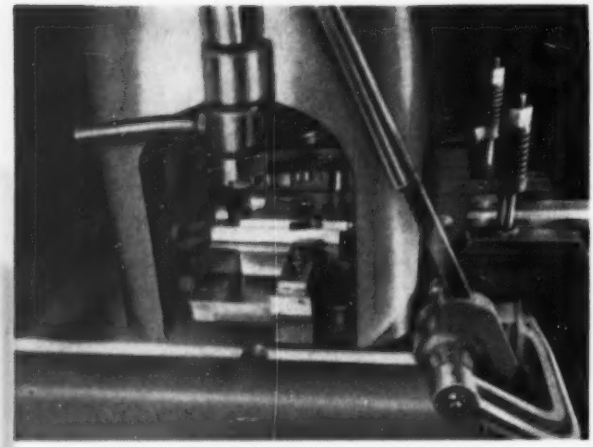
120 surfaces of cast iron compressor heads per hour, removing 1 1/2" stock with Mattison No. 24 Rotary Surface Grinder



900 connecting rods per hour, using 40 station fixture to finish grind crank and wrist pin end of assembled rod with Mattison No. 72 Grinder

Shows variety of work run on Mattison Face Grinders

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS



Close-up view of high speed automatic press showing manner in which stock is fed through progressive type die for producing toggle switch parts

of the parts is 0.020-inch thick phosphor bronze and the operations performed thereon include piercing, notching, shearing, extruding, cutting off, and forming.

Product of the Di Machine Corporation, the 12-ton press used in accomplishing the above operations features a cylinder type ram sliding in an adjustable bronze sleeve. The four-point support construction of the press frame assures the rigidity and accuracy necessary for high production and low die maintenance. A variable speed drive allows for the selection of the proper speed at which the toggle switch parts can be most efficiently produced.

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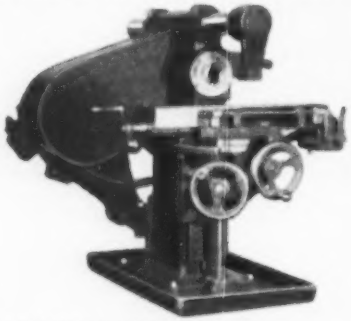

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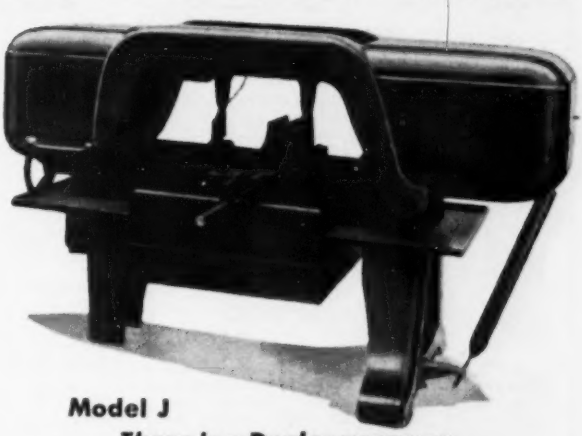
lead the way in the metal-cutting field. They last indefinitely and deliver the most in time-saving accuracy and efficiency. They are adaptable to any cutting job. Quick change from light to heavy stock requires only a minute. Model J, pictured, capacity, 10" rounds, 18" flats. Smaller lighter Model B, capacity 5" rounds, 10" flats.



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SAWS	¼" - 1¼"	¼" - 1¼"	¼" - ¾"

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The particular die used in the press is a six-station progressive type designed and built in the plant of Di Machine. The work strip is fed automatically through the various stations of the die to the final station where the cutting off and forming of the legs of the switch part take

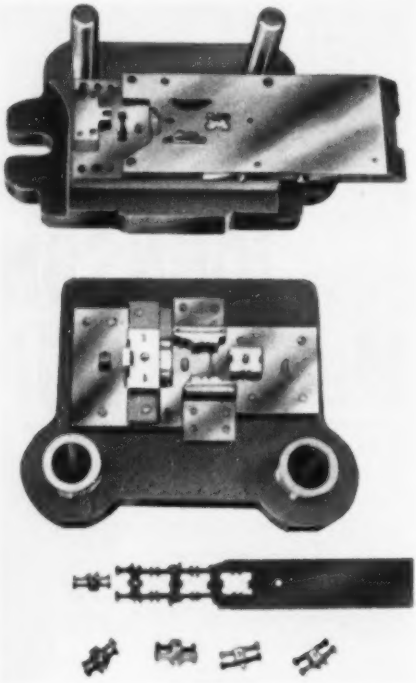


Illustration showing six-station progressive die used in producing toggle switch parts

place and the blank is ejected by air. Riser pins are situated in various places in the die to lift the stock from one station to the next and prevent the material from catching on the die edges. The material is supported and guided between the feed rollers and die to prevent buckling and avoid misfeeding.

The rate of production with this equipment is 7,000 pieces per hour.

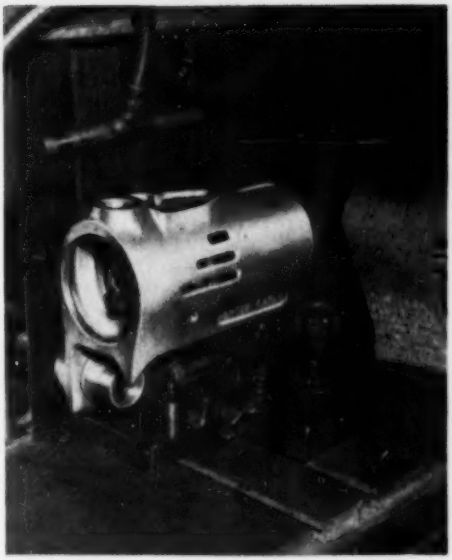
Saves .97 hrs. per 100 pieces
BY PORTER-CABLE Abrasive Belt Machining

THE PROBLEM—To machine a cast aluminum chain case boss with true flatness and to close tolerance, so that exact fit of cover will prevent grease leaks.

PREVIOUS METHOD—Boss was surfaced by a milling machine.

SOLUTION—The job was placed on a Porter-Cable BG-8 wet-belt grinder, using No. 80 grit abrasive. Coolant: soluble oil.

RESULTS—1.60 hrs. per 100 pieces were required by abrasive belt machining as against 2.57 hrs. required by the previous method. That's saving .97 hrs. per 100 pieces. This saving applied to cutting time alone. Finish obtained by abrasive belt grinding was superior to that obtained by milling.



MODEL BG-8 (with automatic feed table) A precision surfacing machine for repeat operations. Eliminates expensive fixtures. 8" wide belt works on entire areas at once. Quickest method on interrupted areas. Other machines for many different applications.

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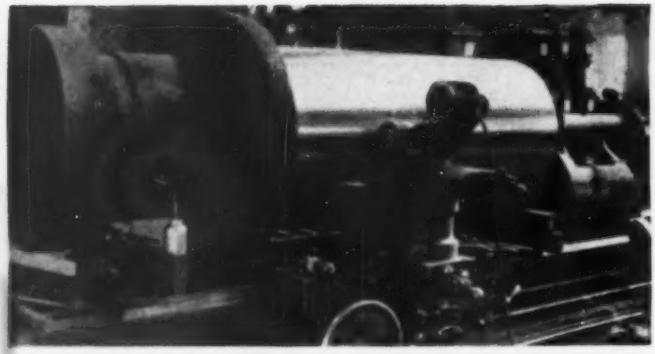

Finish grinding press ram after metallizing

Metallizing Improves Wearing Quality of Press Ram

THE hydraulic press ram shown in the accompanying illustration had worn about ¼ inch undersize on its diameter, and its surface was so badly scored that scrapping was considered since its condition made further service practically impossible. With metallizing, however, the ram was built up with Metcoloy No. 2 in the shop of the Hamilton Bridge Co., Hamilton, Ontario. The 5-foot long x 28-inch diameter worn section required approximately 150 lb. of the high-chrome, high-carbon stainless steel alloy. The first finishing cut was taken with a cemented carbide tool, and the final finish machining was done with a tool post grinder to provide the required close tolerances. The completed ram now has a very hard and highly finished surface which promises a greatly extended service life.

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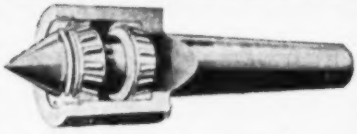

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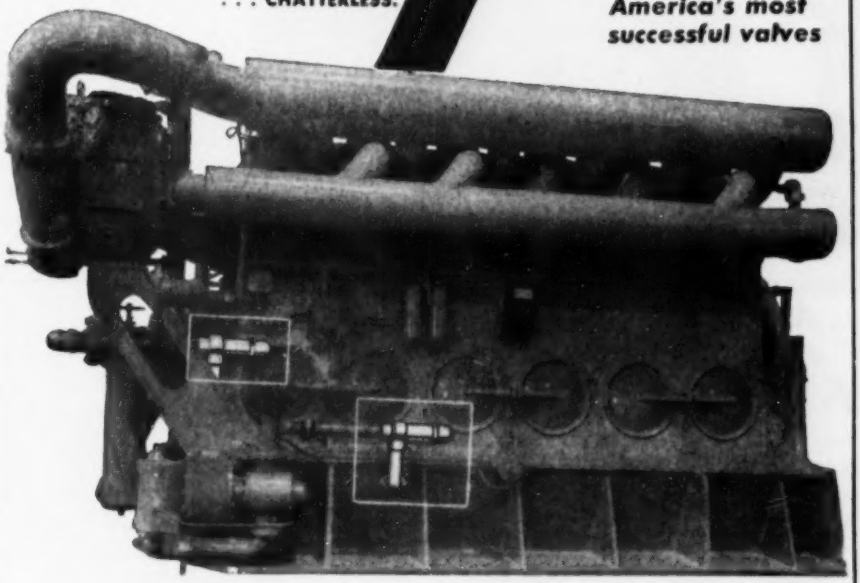

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THE FULFLO Specialties Co., Inc.
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A 52-inch vertical boring and turning machine with contouring attachment is currently being used to speed production at the plant of a large manufacturer of jet engines.

Boring Mill with Contouring Attachment Speeds Jet Engine Production

A 52-inch vertical boring and turning machine with hydraulically controlled tracer attachment is now said to be establishing new records for rapid production in the plant of a large manufacturer of jet engines. In addition to the tracer attachment, the machine, which was designed and constructed by the King Machine Tool Division of American Steel Foundries, is equipped with a swivel turret head and a special four-way tool block on the left-hand ram head.

The machine combines automatic contouring and manual roughing with automatic depth control, and, in addition, by shifting one lever the contouring attachment can be disconnected and the machine can then be used as a standard vertical boring mill. The machine is of massive, rugged construction with sufficient weight and rigidity to assure maximum accuracy and stock removal at the high speeds with which the jet engine parts are

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20" Long x 12" Wide x 6¼" Deep
16 Ga., drag holes, handles both ends.
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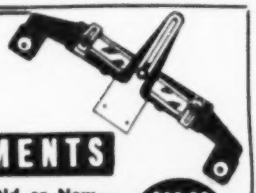
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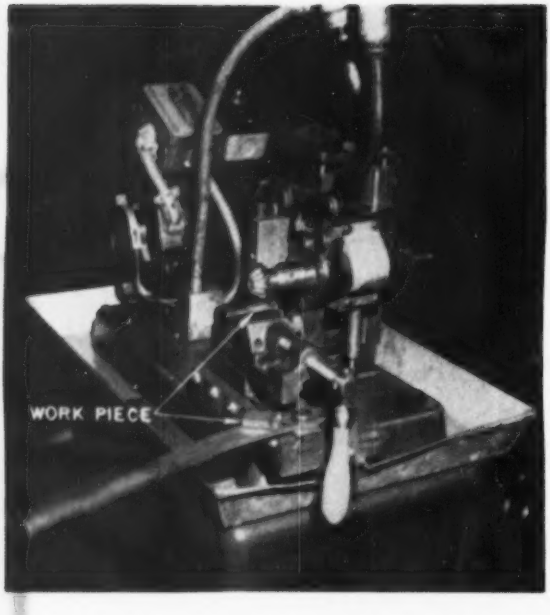

Illustration showing setup for slotting and beveling rectangular type workpieces on a hand miller

machined. All controls are conveniently located at the front of the machine, easily accessible to the operator.

Hand Miller Adapted to Slotting and Beveling Operation

THE ACCOMPANYING illustration shows the use of a hand miller in slotting and beveling rectangular type workpieces. The slotting and beveling operation is performed through the use of two cutters, while the workpiece is held in a vise mounted on a sliding table fixture.

Previously, the slotting and beveling operation was performed on a large mill using an expensive setup; however, with the equipment shown, the production rate has been increased approximately one-third, with setup costs greatly minimized. Moreover, knock-down of equipment has been eliminated since the machine illustrated is set permanently for the job which is rerun frequently. The production rate with this equipment is 480 parts per hour.

The hand miller, as well as the vise and the sliding table fixture, is a product of H. B. Rouse and Company.

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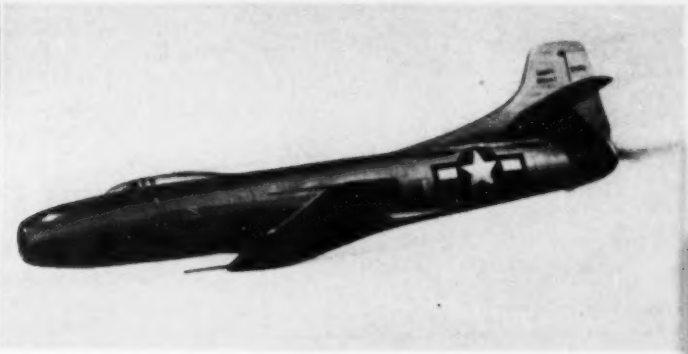

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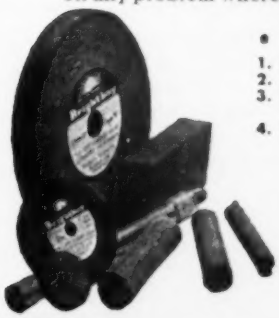

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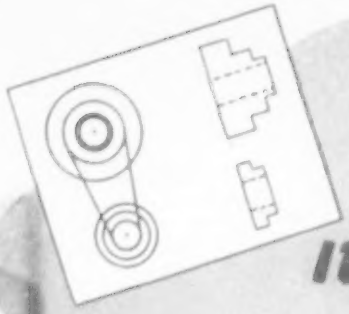


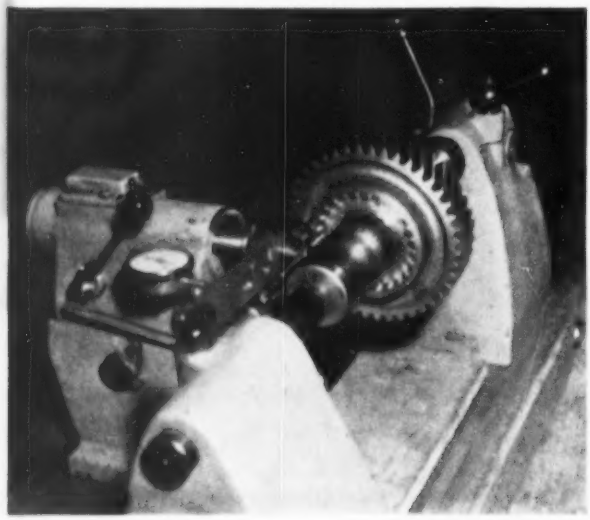
IDEAS FROM READERS

Special Fixture for Checking Eccentricity of Internal Gear Teeth

By Herbert Chase

CLARK EQUIPMENT COMPANY at its Jackson, Michigan, plant built the fixture shown herewith for checking the eccentricity of internal clutch gear teeth of transmission spur gears relative to the splined gear holes. The fixture includes a headstock and tailstock with centers, between which is held a splined arbor on which the gear to be checked is mounted. A Fellows tooth-spacing head installed on the fixture carries a ball point which is mounted with its shank axis parallel to the arbor.

To determine the degree of eccentricity of the pitch circle of the internal teeth, the ball is set so that the dial indicator shown in the illustration reads zero when the ball is in contact with two teeth having a pitch circle concentric with the arbor. The ball is then moved out of mesh with the teeth and the gear is rotated to different positions, at each of which the ball is brought back to bear between two teeth. If the pitch circle of the



Fixture designed for measuring the eccentricity of internal clutch teeth relative to the axis of transmission spur gears, one of which is shown on an arbor between centers

teeth is eccentric, the dial gage indicates the amount of eccentricity. These readings tell whether or not eccentricity exceeds the maximum limit permitted.

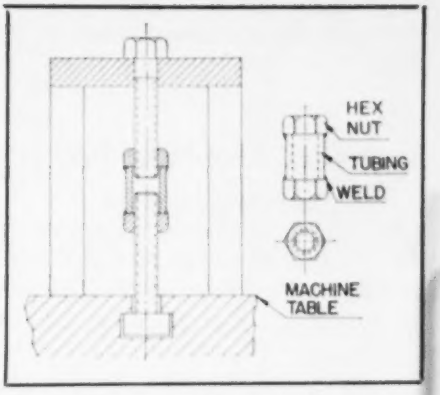
The fixture is convenient to operate and sufficiently rapid to meet inspection requirements.

An Inexpensive T-Bolt Extension

By Irwin Mansfield

IN clamping various parts to a machine table, it often happens that the T-bolts available are not long enough to hold the parts. Instead of stocking a large assortment of odd-size T-bolts, it is suggested that a simple, inexpensive adapted device, such as the one sketched herewith, be used.

The device consists essentially of two standard hex nuts which are welded onto the ends of a round piece of tubing. Two standard T-bolts are then threaded into the hex nuts in order to hold a workpiece in place. The I.D. of the tubing used is slightly larger in diameter than the O.D.'s of the T-bolts. The length of the tubing may



Sketch of a simple T-bolt extension device

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The FISCHER No. 1 Oil Groover cuts a wide variety of grooves in bearings up to 8" in length and up to 5" inside diameter. A few simple settings permit you to cut continuous, relieved, straight or spiral grooves at any angle from parallel to perpendicular to the work. Grooves may also be cut in shafts, housings, etc.

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be made as long or as short as is desired and depends upon the size of the work to be held.

Universal Two-Hole Drill Jig

By Frederico Strasser

FOR short-run drilling operations on workpieces similar to that shown in Fig. 1 on which the center distance, **X**, between the two holes must be accurately maintained on piece after piece, the writer has devised a handy universal drill jig, as shown in Fig. 2, which is particularly useful where no jig boring machine is available. The jig consists essentially of a toolmaker's vise, **A**, with a specially made pair of jaws, **B**, side stop, **C**, and bushing carrier, **D**. Each jaw is machined with a step so that the workpiece, **E**, does

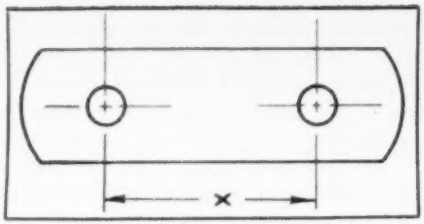
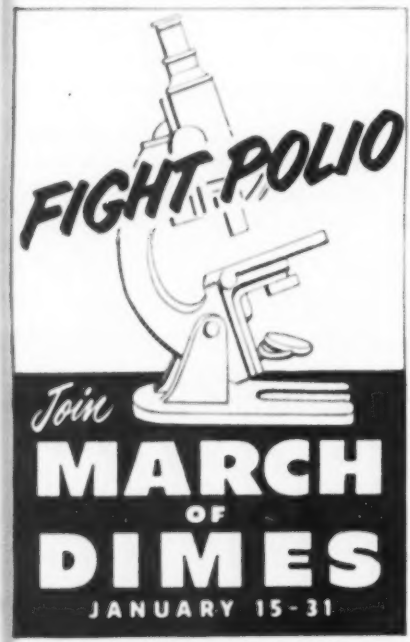


Fig. 1—Sketch of part to be drilled in universal drill jig shown in Fig. 2.



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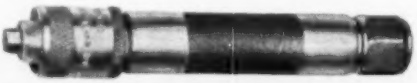
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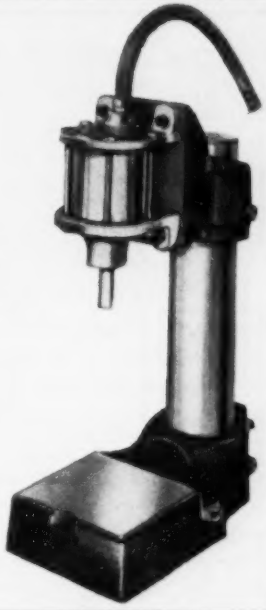

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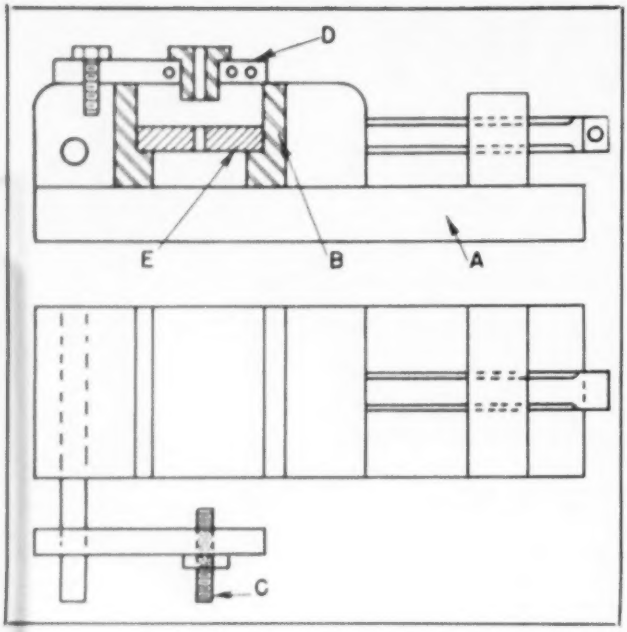

Fig. 2—Universal jig for drilling pairs of holes in parts on accurately held center distances

not rest directly on the vise body where chips or foreign matter could cause uneven setting of the piece.

The side stop can be devised and applied to the vise in several different ways. The bottom view in Fig. 2 shows a good arrangement in which one end of an L-shaped rod is fastened to the stationary jaw of the vise and the other end provided with a screw and clamping nut which form the stop proper. As shown in Fig. 3, the bushing carrier, **D**, includes a frame which is designed to hold in accurate parallel alignment two drill rods, **F**, and a screw, **G**, which are fitted through two bushing holders, **H**, that can be adjusted back and forth to provide any desired center distance between the holders and locked in place by means of the hexagon nuts, **I**.

Fig. 3 also shows cross-sectional views of the two bushings inserted in the bushing holders. The outside diameter of the head of each bushing is machined to a round value (e. g. 0.5 inch) so that when the bushings are inserted in the holders, the exact center distance between each bushing can be quickly determined by measuring with a micrometer the distance, **M**, from

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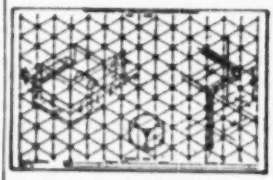

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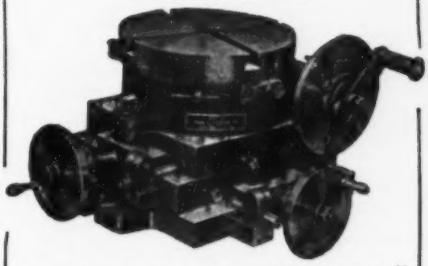

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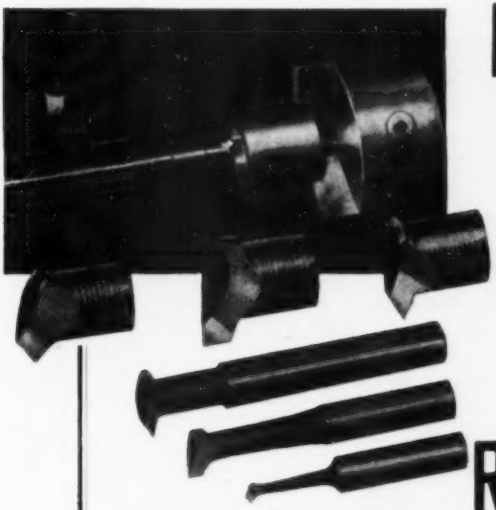

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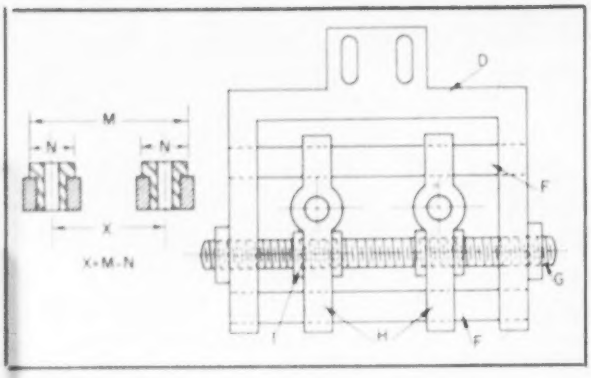

Fig. 3 — Detailed sketch of bushing carrier used on jig shown in Fig. 2

one bushing head to another and then subtracting from this measurement the outside diameter, N, of one bushing head.

To use, the bushing carrier is mounted on the stationary jaw of the vise, the bushing holders are adjusted to the desired center distance, and the side stop is set to provide for proper location of the workpiece in the jig. The two holes are then ready to be drilled in the piece in the same manner as with a standard drill jig.

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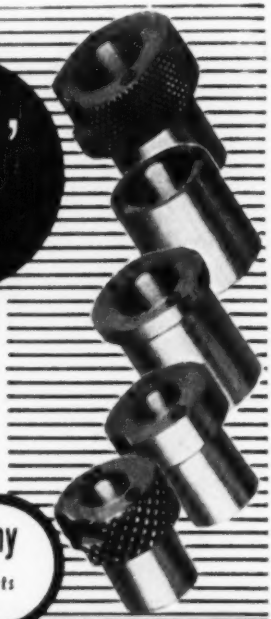

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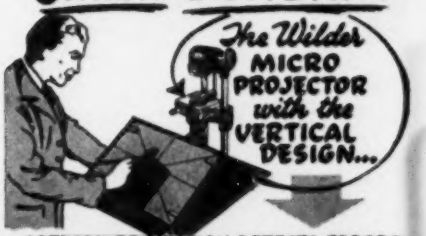

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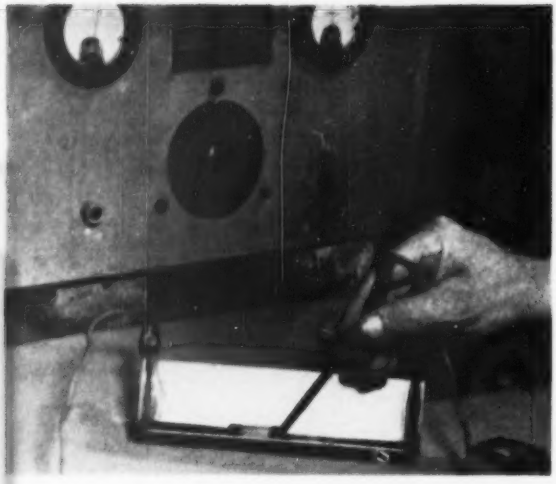

This illustration shows an easy method for removing discoloration from a stainless steel weldment. The part is connected to a power source; acid solution is applied to the weld area; and a copper tool is passed along the weld.

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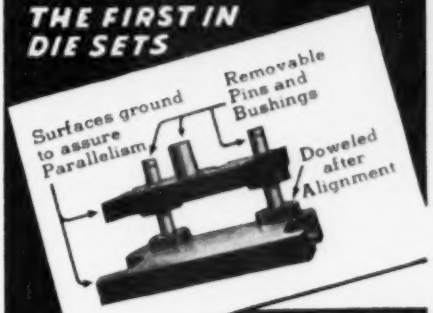

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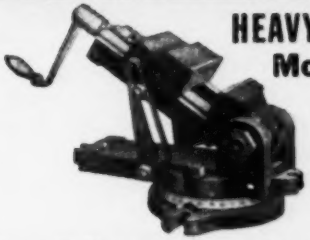

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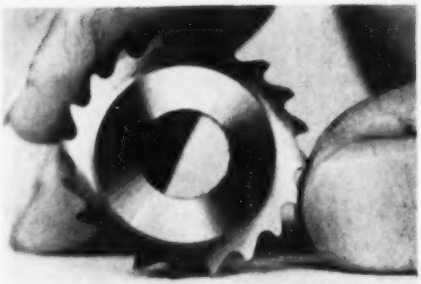

Fig. 1—Solid carbide saw used to mill slot in end of stainless steel pin shown in Fig. 2

Fig. 1 shows the design of the saw used in performing the slotting opera-

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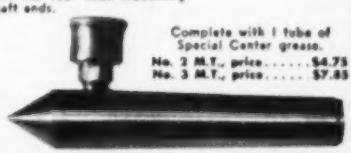

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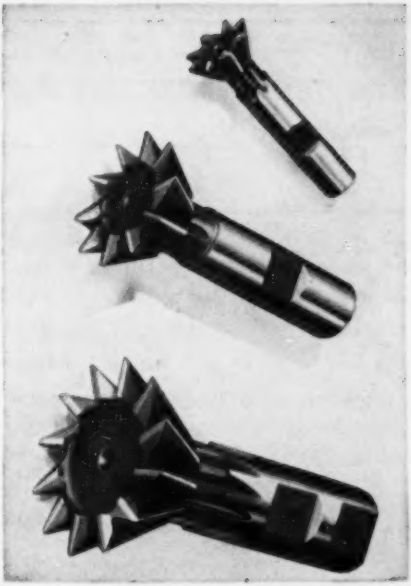

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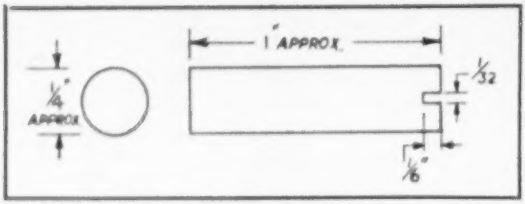

Fig. 2—Sketch of stainless steel pin slotted with solid carbide saw shown in Fig. 1

tion, while Fig. 2 is a sketch showing the dimensions of the stainless steel pin slotted with this saw.

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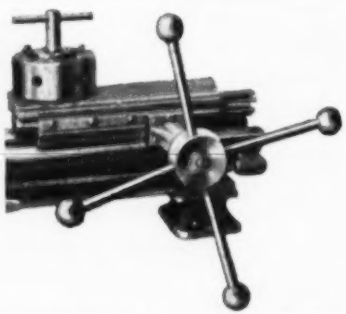

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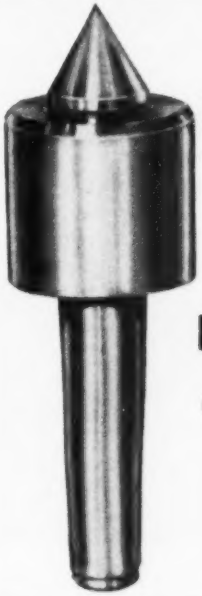

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News of the Industry

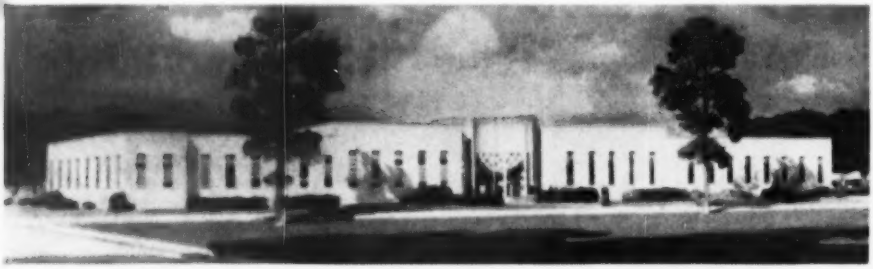
Engineering Services Building Under Construction by Eutectic

Eutectic Welding Alloys Corporation of New York has announced that construction is under way on a new Engineering Services Building at the site of the company's new plant in Flushing, Long Island. The new building is being added to provide 20,000 more square feet of space to meet the increased demand throughout the welding industry for additional engineering information and assistance in exploiting the advantages of the company's welding rods for improving welding techniques and solving metals-joining problems.

Eutectic's building program has been especially planned with an eye to providing sufficient and suitable facility to meet any scale of demand for welding materials likely to arise out of a war emergency with its mounting requirements and critical shortages. One of the many up-to-date features of the new structure is an air raid shelter. The additional laboratory facilities in the Engineering Services Building will provide further space for continuous welding development research, together with specially designed areas for experimental analysis and testing on welding problems. The most modern architectural features have been incorporated in the new building to ensure comfortable surroundings and working efficiency for the engineering, technical, and administrative personnel to be housed there. A customers' conference room is included to furnish facility for customers' representatives visiting the plant to consult on engineering matters.

Arc Welders Tested at 65 Degrees Below Zero

Hobart Brothers Company has started operations on new facilities at Troy, Ohio, to test its products under



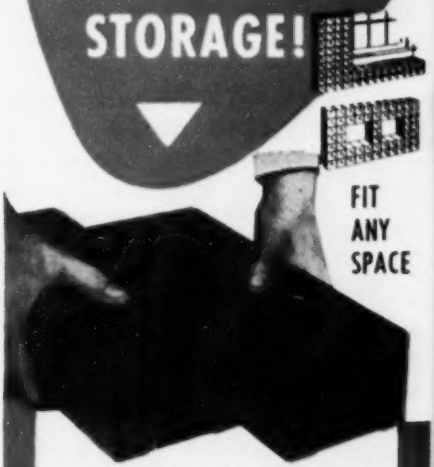
Architect's drawing of new Engineering Services Building of Eutectic Welding Alloys Corporation now under construction at the site of the company's No. 2 Plant in Flushing, Long Island, New York

sub-zero conditions. In a special cold room with an intermediate chamber to reduce cold losses in entering or leaving the cold chamber, Hobart products are now being tested at temperatures ranging down to 65 degrees below zero.

Testing equipment consists of a graphic thermometer for continually charting ambient air or room temperature within a range of minus 100 deg. F. to plus 100 deg. F.; an indicating potentiometer which has 24 stations, is self-balancing, and is calibrated directly in degrees Fahrenheit within a range of minus 100 deg. F. to plus 1200 deg. F. with appropriate thermocouples; a two-way sound system so that observers conducting tests can communicate with technicians outside the room; and an inspection window with six panes of thermo-glass to maintain insulation.

Illustration showing a technician starting tests on a kw. generator

The answer to SMALL PARTS STORAGE!



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12 Large Multi Drawers 11 1/16" x 3 1/16" x 3" deep. Less than 12—99c each. Accommodates 5 drawer dividers — 5c each — Part No. M1213.

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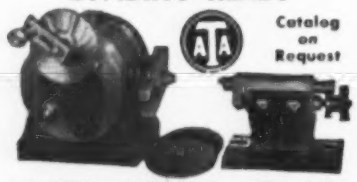
Porter-Cable Buys Johnson Corporation

DeAlton J. Ridings, president of the Porter-Cable Machine Co., Syracuse, N. Y., has announced that his company has completed the purchase of the Johnson Engineering & Sales Corp., Rockford, Ill. The purpose of the move is to extend Porter-Cable's line of electric tools in order to provide a complete selection of portable woodworking machines.

The Johnson Corporation manufactures air-driven sanding machines used primarily in the furniture and automotive industries. These sanders will become a part of Porter-Cable's Speedmatic line of electric tools which includes saws, abrasive belt sanders, routers, shapers, planes and lock mortisers. The firm also manufactures a line of Guild homecraft tools, floor sanding machines, and industrial abrasive belt grinders.

The purchase of the Johnson Corporation is the third major acquisition made by the Porter-Cable Machine Company since the fall of 1948. Approximately a year ago, the firm purchased the manufacturing rights and facilities of the Sterling Tool Products Company of Chicago and has since been manufacturing its orbital motion finishing sanders. In 1948 a line of woodworking equipment, including routers, shapers and planes, was added to the Porter-Cable Speedmatic line through the purchase of the Unit Electric Tool Company of Syracuse, New York. All production facilities of the Johnson Corporation are being moved to Syracuse under the direction of Lloyd B. Benham, vice president and factory manager of Porter-Cable.

CARROLL
DIVIDING HEADS

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3¾" stroke; adoptable for other work.
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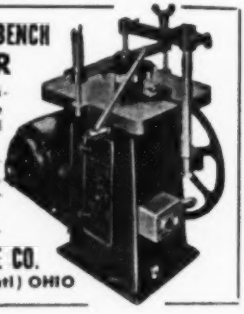
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$2,250 In Prizes for Papers on Resistance Welding

Announcement has been made of cash prizes to be awarded in 1951 by the Resistance Welder Manufacturers' Association for outstanding papers dealing with resistance welding subjects. The total amount of the awards is $2,250.00, and a wide choice in subject matter is allowed in order to assure eligibility to all papers which cover worthwhile and significant achievements in the field. The contest judges will be appointed by the American Welding Society, and awards will be made at the 1951 fall meeting of the society.

For the best paper from an industrial source, consulting engineer, or private or governmental laboratories, $750.00 will be awarded. Awards of $500.00 and $250.00 have been set aside for second and third prizes in this classification. $300.00 will be given for a university source, either an instructor, graduate student, or research fellow. The second prize in this catagory is $200.00. For the best paper from an undergraduate student, an award of $250.00 will be made.

All papers became the joint property of R. W. M. A. and American Welding Society. Papers must be typewritten, double spaced, on white paper and on one side only, with enclosures firmly attached and clearly identified. They should be mailed to the American Welding Society, 33 W. 39th St., New York 18, New York.

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Built by the makers of the famous Onsrud air turbine grinders and motors. The Onsrud D1-S Hole Grinder is a precision made unit for finish hole grinding and related operations . . . for mounting as tool on jig borer, milling machine, lathe, radial drill or similar machine. Onsrud air turbine motor design is your guarantee that spindle speed and power will be maintained as work pressure is applied. Offset head position adjustable to 0.0001" accuracy. For holes up to 4" diameter.

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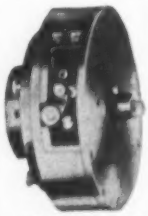
Lewis John Firth

Lewis John Firth, former chairman of the board of Firth Sterling Steel and Carbide Corporation, died November 3, 1950, in Pittsburgh after a prolonged illness. Born in England in 1858, Mr. Firth, at the age of 16, entered the employ of Thos. Firth & Sons, Ltd., Sheffield, a business founded by his grandfather in 1840. In 1881 he became a director of Firth's and later joint managing director.

Lewis John Firth

On his first visit to the United States in 1874, Mr. Firth spent much time with Jere, Abbott and Company, now Wheelock, Lovejoy and Company, who were agents for Firth's. The growing American business indicated the need of a plant in this country and he was instrumental in persuading Firth's to acquire control of the Sterling Steel Co., McKeesport, Pa., a small mill making quality tool steels. The new Firth Sterling Steel Company, with Mr. Firth as president, took over the business in 1897.

As an industrial pioneer, Mr. Firth was associated with the formation of many companies in the fine steel business. Moreover, he brought into the tool steel business many men who have since become leaders. Mr. Firth remained as president of Firth Sterling until 1937 when he was succeeded by his son, L. Gerald Firth. He then became chairman of the board of directors until 1944 when, at the age of 86, he retired from active business after having completed 70 years in the tool steel industry.



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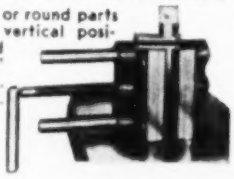
3-WAY SHUR-GRIP Drill Vise

Vise holds square or round parts in horizontal or vertical positions. Hardened vise jaws are 5" wide and open 5". *Write for folder.*



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Midland Purchases Manufacturing Rights of Starbilt Storage Equipment

The Midland Mfg. Co., Wichita, Kan., has announced the purchase of all rights to the manufacture of Starbilt storage equipment formerly produced by the Star Mfg. Co., Oklahoma City, Okla., at its plant in Kansas City, Kan. A modern steel building with 15,000 feet of floor space is presently under construction in Wichita and full production is expected in the near future. Midland will continue to manufacture storage equipment under the trade name Starline, with production concentrated on steel industrial bins and shelving for the first few months after the new building has been completed. Other new products, such as lockers, counters, cabinets, and shop storage equipment, will be added as quickly as possible.

The Midland Manufacturing Company is a partnership of Carl Hiatt and E. E. Colwell, both active in Wichita business activities. The Starline products will be the same as that formerly produced by the Star Manufacturing Company, and parts will be interchangeable with presently installed equipment. One of the features of the production line is the overhead conveyor system. The entire operation is designed so that raw materials enter at one end of the plant and finished products flow out the other end ready for shipment.

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If your requirements for *special tools* are slight alterations of standard tools, Staples can meet your special requirements and ship within several days.

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CARBIDE-TIPPED CUTTING TOOLS

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S. A. M. Schedules Western Industry Clinic

Greater efficiency in production through work measurement and methods improvement will be the chief topic of the clinic for western industry scheduled for January 30 and 31 in Los Angeles, California, under the sponsorship of the Los Angeles Chapter of the Society for the Advancement of Management. West coast industry representatives attending the two-day session will hear Dr. Ralph M. Barnes, professor of engineering and production management at the University of California at Los Angeles and also an outstanding authority on time and motion studies and related industry problems.

Included in the intensive concentrated work course will be discussions on The Place of Motion and Time Study in a Cost-Reduction Program; Micro-Motion Study; Making Motion Pictures for Training and for Improving Methods; Principles of Motion Economy; Determination of Performance Rating Factor; Allowances in Time Standards; Setting Base Rates; Wage Incentives; and the Barnes' Work Measurement Project in which all attending the course may participate. Lectures will be augmented by books and reference papers supplied as part of the cost of the conference.

The clinic provides a practical and realistic program applicable to plant managers, superintendents, foremen, industrial engineers, methods men, cost accountants, and office executives. Information regarding admission may be obtained by addressing George H. Pickett, c/o Southern California Gas Co., 810 S. Flower St., Los Angeles 17, California.

ONE-OF-A-KIND SPRINGS

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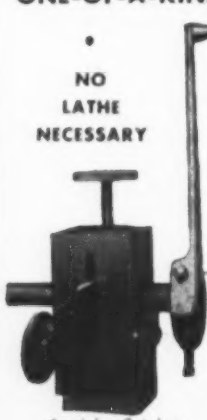

1. 60 second action for a spring 12" long.
2. Ideal for tool room, research lab. and repair shops.
3. Mandrel capacity to 1½".
4. Wire capacity up to .229" diameter.
5. Pitch capacity up to 1".
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SAFETY RADIUS DRESSER

• Key tool men are safe from sparks and flying grit because this dresser works beneath the wheel, and the wheel guard can always be left in place. • Capacity: concave, 2½"; convex, 1¾". Maximum wheel size 8". • Overall dimensions: 6" x 6" x 3" wide. Weight 16 lbs. • Price with diamond $85.00. Send for Catalog.

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20th National Packaging Exposition

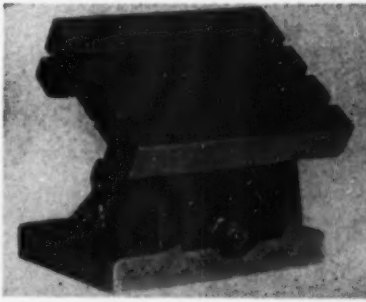
The American Management Association has announced that it will sponsor its 20th National Packaging Exposition April 17-20 at the Auditorium in Atlantic City, New Jersey. Machines, equipment, and services used in packaging packing, and shipping will be on display, and it is expected that the show will be larger than ever before, in both area occupied and number of exhibitors.

The week of April 16 has been designated as "Packaging Week." Events scheduled include not only the exposition but the A. M. A. Packaging Conference which will be held in conjunction with the show. In addition, a number of industry groups are planning special meetings during the exposition days. Arrangements for the exposition are under the direction of Clapp & Poliak, New York City. Robert D. Handley, advertising manager, Sylvania Division, American Viscose Corporation, is chairman of the exhibitors' advisory committee.

Westboro Grinding Wheel Plant Continues Expansion

The board of directors of the Bay State Abrasive Products Co., Westboro, Mass., has voted an appropriation of $100,000 for factory expansion and manufacturing equipment to cope with increasing demand for the company's products. This sum is in addition to $250,000 that was appropriated in May of 1950 for a similar expansion program that is now carried out. Contracts for the additional work have al-

ALL-ANGLE PLATES



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c.	3½"x4" (Sine plate)	$125
e.	9"x12" (worm drive, compound angle)	$250

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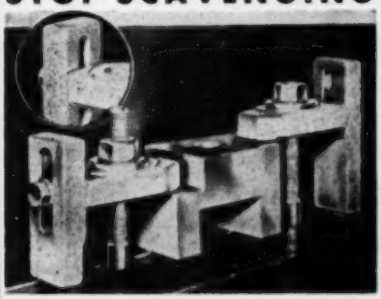

• Quickly switch from large to small workpieces without time wasting, tedious hunting of scrap shims. How? Easy with these drop forged, serrated clamps. Holds work up to 6" high.

• Set contains crosspieces (2 plain, 2 goosenecks) and uprights (2 each of 2", 3", 4" and 6"). Crosspieces take up to ⅝ T Bolts. $17.50.

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ready been released and work is now in progress, including additional factory space on 6,400 square feet to house a new tunnel kiln already purchased.

J. Calvin Brown Elected President of A.S.M.E.

The election of J. Calvin Brown, engineer and patent attorney of Los Angeles, as president of the American Society of Mechanical Engineers for 1951 was announced at the society's 71st annual meeting held recently in the Hotel Statler, New York City. Mr. Brown took office at the conclusion of the meeting, together with four regional vice presidents and two-directors-at-large who were also elected.

The new president succeeds James D. Cunningham of Chicago. A mechanical engineer and attorney at law specializing in patent, trade mark, and copyright litigation, Mr. Brown became a member of the A. S. M. E. in 1928. He served as manager of the society in 1943-44 and as vice president from 1945 to 1949. Mr. Brown is a member of the bars of the U. S. Supreme Court and federal and state courts in Illinois, District of Columbia, and his native state.

Regional vice presidents elected are: Henry Reginald Kessler, manager, Republic Flow Meters Co., New York; Stephen Dewey Moxley, vice president, American Cast Iron Pipe Co., Birmingham, Ala., Dr. John T. Rettaliata, dean of engineering, Illinois Institute of Technology, Chicago; and Carl J. Eckhardt, (reelection) professor of mechanical engineering and superintendent of utilities, University of Texas, Austin. Elected as directors-at-large are: Lionel J. Cucullu, assistant to chief engineer, New Orleans Public Service, Inc., New Orleans, La., and Harold E. Martin, district manager, The Babcock & Wilcox Co., New York, New York.

1951 Metal Powder Show

The 1951 Metal Powder Show, in conjunction with the Seventh Annual Meeting of the Metal Powder Association, will be held at the Hotel Cleveland, Cleveland, Ohio, on April 25-26,

THE extent to which American business contributes to world industry is indicated by the recent equipment which The Webb Corporation, Webb City, Missouri, shipped to Chili, South America. The pioneer Missouri manufacturer of mining and industrial machinery made the giant plate bending roll shown herewith for the Kennecott Copper Company, one of the many American firms contributing to Latin America industrial development. The unit weighs approximately 60 tons and required three flat cars to move it from the Webb City plant to seaboard for export shipment.

1951. Additional information regarding the exhibit and the technical program may be obtained from the Metal Powder Association, 420 Lexington Ave., New York 17, New York.

Airco to Build Modern Manufacturing Plant

Immediate construction of a new manufacturing plant of approximately 272,000 square feet on a 25-acre plot at Union, New Jersey, has been announced by John A. Hill, president of Air Reduction Co., Inc., New York. The new facility, providing for the employment of approximately 800 persons, will be used by the Airco Equipment Manufacturing Division of Air Reduction Company, Incorporated, for the manufacture of welding and cutting torches, tips, regulators, oxyacetylene cutting machines, inert gas arc welding machines, acetylene generators, oxygen and acetylene manufacturing and distribution equipment, and so on.

The plant, which is to be of brick and steel construction with all working area on one floor except 18,000 square feet of office space, will be located on property adjacent to the main line of the Lehigh Valley Railroad and within close proximity to U. S. Route 22 and New Jersey State Highway 29. The new plant is expected to be ready for occupancy by the company early in the coming spring.

NEW simple accurate versatile Odee-HONE
For honing all types of External Cylindrical Surfaces. A single tool for all parts from ½" to 2½" in diameter.

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Shafts	piston rods	Die pins
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62 | 2 | 1/4 to 1/2
64 | 4 | 5/16 to 5/8
With 15° or parallel cutter channel, left or right hand
ROBERT H. CLARK COMPANY
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FULL BALL BEARING
Completely Adjustable
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DRILLHEADS
STANDARD Only with
THRIFTMASTER
Full Ball Bearing construction coupled with Thriftmaster design and manufacturing dependability, assures smooth, steady, positive drillhead performance that will last!
THRIFTMASTER Universal Joint Drillheads
3 to 10 (or more) Spindles . . . Capacity to 7/8" in Cast Iron
6" to 10" (or larger) Circle
OTHER THRIFTMASTER PRODUCTS
Special Fixed Center and Standard Eccentric Adjustable Drillheads, Multiple Spindle Automatic Reverse Tap or Drill Attachments.
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Awards Conferred by Mechanical Engineers

Distinguished American engineers, scientists, and inventors were honored at the 1950 annual meeting of The American Society of Mechanical Engineers. The highest award of the society, the A.S.M.E. Medal, was presented to Harvey C. Knowles, vice president of the Proctor and Gamble Defense Corporation of Cincinnati. The medal, conferred annually for distinguished service in engineering and science, was awarded to Mr. Knowles for contributions to the process industries and loading of ammunition.

The Holley Medal for inventions of great public benefit was awarded to Charles G. Curtis, president of International Curtis Marine Turbine Company of New York and inventor of the Curtis steam turbine in 1896 and the first American complete gas turbine power plant. Orland W. Boston, professor and chairman of the Department of Metal Processing, University of Michigan, was presented with the Worcester Reed Warner Medal for his lasting contributions to the art of cutting metals which "have improved the productive capacity of American industry, stimulated broader research and enriched engineering education." To Burgess H. Jennings, professor and chairman of the Department of Mechanical Engineering, Northwestern University, went the Richards Memorial Award for outstanding achievement in mechanical engineering within 20 to 25 years after graduation.

The Melville Prize Medal for the "best original paper or thesis on any mechanical engineering subject presented before the A.S.M.E. the previous year" was presented to Samuel J. Loring, consulting engineer, Hamilton Standard Propeller Division,

United Aircraft Corp., East Hartford, Conn., for his paper, "A Theory of the Mechanical Properties of Hot Plastics." The Pi Tau Sigma Gold Medal went to Arthur P. Adamson, who is in charge of a group in the Navigation Control Section, Systems Development Division, Aeronautic & Ordnance Systems Divisions of the General Electric Company, concerned with the development of steering systems for guided missiles. The medal is for "outstanding achievement in mechanical engineering within ten years after graduation."

Honorary memberships in the society were conferred on: Oliver Vaughan Snell Bulleid, consulting mechanical engineer, Coras Iompaire Eireann (Irish Transport Undertaking), Dublin, Erie; Harold Vinton Coes, executive vice president, National Management Council, N. Y.; Dr. Lillian M. Gilbreth, president of Gilbreth, Inc., Montclair, N. J.; Dr. Frederick Ljungstrom, Aktiebolaget Ljungstrom Amgturbin, Stockholm, Sweden, and Harry Miller Pflager of St. Louis, inventor and engineer.

P. M. P. Doubles Powdered Metal Fabrication Capacity

Powdered Metal Products Corporation of America, Franklin Park, Ill., has announced completion of plans for a new addition to its Belmont Avenue plant which will double present production capacity. The new plant addition will house presses for actual piece-part production and provide additional toolroom facilities for the production of the special dies required in powdered metal fabrication.

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Cost Reduction

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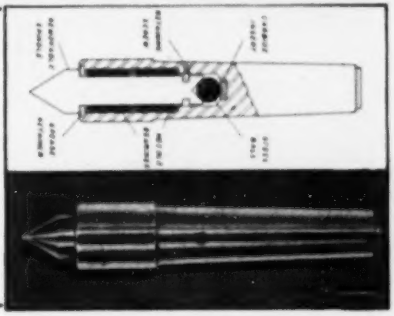
The exclusive SMALL HEAD design of WEE Live Centers fits them for any operation. No interference with slide or tool. Unequalled precision. Runout held to .00015 maximum. No. 2 M.T., $21.00. Request complete price list.

Write direct. If distributor cannot supply you,

HERBERT CROSS & SON, Bala-Cynwyd, Pa.



A.S.T.E. President Appointed Machine Tool Consultant to N.P.A.

The American Society of Tool Engineers has been notified of the appointment of Herbert L. Tigges, president of the A. S. T. E., as advisor and consultant on machine tools to the National Production Authority in Washington. Mr. Tigges, who is also executive vice president of Baker Brother, Toledo, has for some time headed the Machine Tool Industry Mobilization Reserve group, initially set up as an "unofficial group" at the instigation of the N. S. R. B. In his official capacity, Mr. Tigges will spend several days each week in Washington at present to advise the N. P. A. on problems relating to the machine tool industry.

Annual Management Conference

On February 1 and 2, 1951, the Annual Management Conference will be held on the Chicago campus of Northwestern University where the problems of a "butter and gun" economy will be discussed. Panel and group discussions will be held after noted speakers review the current economic conditions and problems that arise when production is increased during a manpower shortage.

A record attendance is expected since the meetings are open to nonmembers who forward a registration fee of $15.00 to the Program Chairman, Society for Advancement of Management, Northwestern University School of Commerce, Chicago, Illinois.

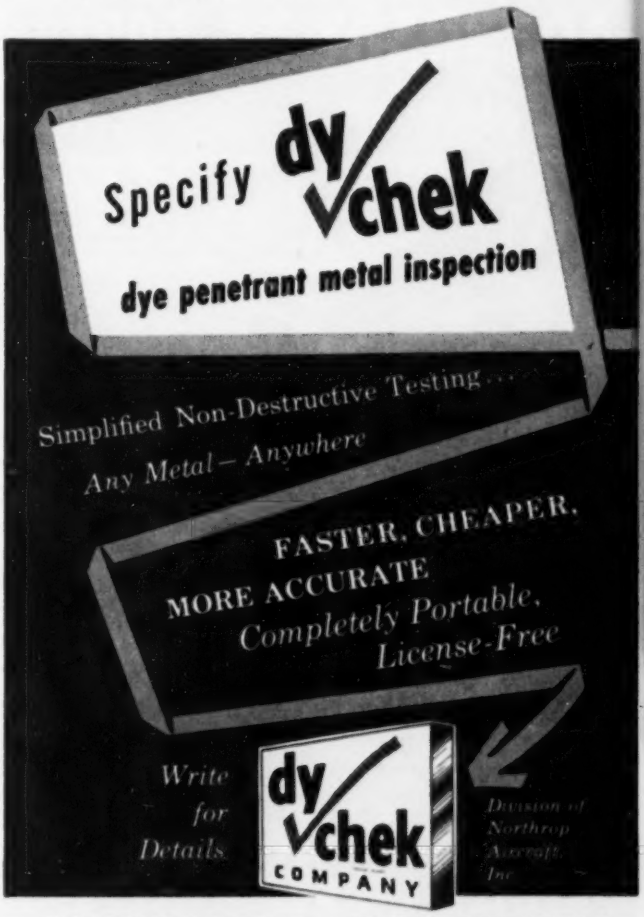
A.S.L.E. 1951 Convention

The 1951 National Convention of the American Society of Lubrication Engineers will be held in Philadelphia on

April 16, 17, and 18 at the Bellevue-Stratford Hotel. Preliminary details issued by W. F. Leonard, national secretary, indicate a program expanded over previous years in range of interest for top management, design engineers, production engineers, and lubrication and maintenance specialists, and others.

Emphasis is on practical application of the latest scientific advances in lubrication techniques. Papers and discussions will feature general plant lubricants and their application, internal combustion engines, drawing compounds, soluble oils, wire rope lubrication textile machinery lubrication and minimizing of oil deterioration.

Prominent authorities who will address the convention include J. T. O'Reilly, Ford Motor Company, on "Drawing Compounds"; R. Larsen, Shell Development Corporation, on "Oil Deterioration"; Dr. W. A. Zisman and H. R. Baker, Naval Research Laboratory, Washington, D. C., and H. B. Carpenter, Esso Standard Oil Company, on "Rust Preventives"; W. A. Lewis, vice president, International Business Machines Corporation, on "What Lubrication Means to Management"; R. G. Shepherd, engineer, Standards Department of Factory Mutual Engineering Division, on "Effective Lubrication as a Fire Preventive"; O. M. Albl, lubrication engineer, Thompson Products Company, on "Storage and Handling of Lubricants".



Did You Know That ---

Appointment of **E. A. Erickson** as manager of the Hornell, New York plant of SKF Industries, Incorporated, has been announced by the ball and roller bearing firm. The company has also announced the advancement of **Harry R. Fillmore** from general foreman to the position of assistant plant manager.

McConkey-Docker & Co., 126-132 W. Madison St., Phoenix, Ariz., has been appointed an authorized distributor for the entire state of Arizona by the Carboloy Co., Inc., Dertoit. Carboloy standard tools, standard blanks, carbide-tipped masonry drills, and diamond impregnated carbide wheel dressers will be carried in stock for immediate shipment by the newly appointed distributor.

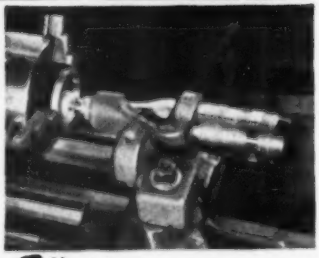
—o—

ACCURACY TO .0001"

FOR TOOL ROOM AND PRODUCTION

FOR AS LITTLE AS $117.50

IN PRECISE MOUNTS ON LATHES AND OTHER MACHINE TOOLS, PRECISE GRINDER-MILLERS WITH 1/4 H.P. AND SPEEDS FROM 20,000 TO 45,000 R.P.M. DO THE WORK OF SINGLE-PURPOSE MACHINES COSTING 100 TIMES AS MUCH!



VERSATILITY. For cylindrical, internal, external and form grinding; for milling with H.S. steel or **tungsten carbide** midget mills; for micro-finishing and polishing. Use on wood, glass, rubber, plastics, or any metal including the hardest alloy steel.

DURABILITY. All metal housing, rigid PRECISE quill, lubricant-sealed, micro-precision bearings. 1/4 H.P. AC-DC motor (115 volts) is protected by replaceable fusetrons.

ATTACHABLE COOLFLEX SHAFT (optional): Quickly attached for bench work and handtool applications. Same speeds, same precision quill as in PRECISE GRINDER-MILLERS.

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PRECISE PRODUCTS CO., 1345 Clark St., Racine, Wis.

PRECISE GRINDER-MILLERS

Harry L. Emerson has been appointed vice president in charge of manufacturing for the Rockford Clutch Division of Borg-Warner Corp., Rockford, Ill. He will also continue as works manager, a position he has occupied for the past eight years.

—o—

Henry L. LeMay has been appointed Chicago district manager by the Mid-West Abrasive Company, manufacturer of sandpaper, grinding wheels, and honing stones. Mr. LeMay will be located in the Railway Exchange Building at 224 S. Michigan Avenue.

Did You Know That ---

Westcott Chuck Co., Oneida, N. Y., has appoinnted **John T. Everett & Co.**, 606 M & M Bldg., Memphis, Tenn., as district representative in Alabama, Arkansas, Oklahoma, Louisiana, Mississippi, Tennessee and Texas.

—o—

O. P. Robinson has been appointed manager of the Pittsburgh district sales office of Cutler - Hammer, Inc., Milwaukee, Wis., electrical manufacturer. Mr. Robinson joined Cutler-Hammer in 1946 as a member of the Chicago district sales office.

—o—

William F. Hagen has been appointed assistant district manager of the New York office of SKF Industries, Incorporated. Mr. Hagen joined and ball and roller bearing firm in 1930 and has been a field engineer since 1943.

—o—

H. S. Sizer, assistant to the director of design, Brown & Sharpe Mfg. Co., Providence, R. I., has been elected to the board of directors of the American Standards Association to serve a three-year term beginning Jan. 1, 1951.

—o—

Market Forge Co., Materials Handling Div., Everett, Mass., has appointed the **A-1 Industrial Equipment Co.**, 812 N. Lawrence St., Philadelphia 23, Pa., as exclusive distributor for eastern Pennsylvania and southern New Jersey.

Switches 3 or more ways from single point
WHEEL OR ROLLER
PORTABLE OR PERMANENT
VERSATILE
FLEX-A-SWITCH
WITH LONG-LEAD SCREW SETTING
A few turns of the crank sets Flex-A-Switch for selected line of converging or diverging travel in power or gravity lines.
Can be used with electrified switching arrangement, stop mechanisms and remote control.
POSITIVE LINE OF TRAVEL
Axles of Flex-A-Switch are divided and are concentric at all settings to assure a positive line of travel. Guards are unnecessary except for extremely fast travel.
Write for Particulars
METZGAR
METZGAR CO.
466 Douglas N. W.
GRAND RAPIDS 4, MICH.

Did You Know That ---

Ladish Co., Cudahy, Wis., manufacturer of forged and seamless welding pipe fittings, has announced the establishment of a branch office at 405-406 Thompson Bldg., Tulsa, Oklahoma, under the managership of **G. E. Mahoney.** Ladish has also announced a change in the address of its St. Louis office to Suite 1605, Continental Bldg., 3615 Olive St., St. Louis, Mo., and the appointment of **W. H. Heckenberg** as district manager of the St. Louis, Missouri office.

—o—

William J. Greene, vice president and director of sales of The L. S. Starrett Co., Athol, Mass., has been elected a director of Motor Equipment Manufacturers Association for a three-year term (1951-1953). Mr. Greene, who has been active during past years in automotive, manufacturing, and industrial distribution associations, has also been appointed to the executive committee of the American Supply and Machinery Manufacturers Association.

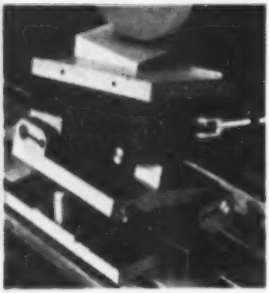
—o—

Robert A. Miller has been appointed sales manager, Gear Coupling Division, Sier-Bath Gear & Pump Co., Inc., 9252 Hudson Blvd., North Bergen, N. J. Mr. Miller, previously advertising manager for the company and assistant sales manager of the Coupling Division, is now in charge of appointing representatives for the company's new line of flexible gear couplings.

ANGULAR SET-UPS

to gauge-block accuracy

IN A FEW MOMENTS



the Magna-Sine

Any angular set-up, single or compound, takes only the time to look up the angle in the Robbins Table of Constants and to insert the indicated gauge blocks between the Magna-Sine plates. It's fast—it's positive, to gauge-block accuracy. Work is held by magnetic attraction. In two models and two sizes; also in non-magnetic models for inspection work.

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OMER E. *Robbins* COMPANY

Manufacturers of the MAGNA-SINE and Other Precision Tools

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Did You Know That ---

Howard L. Timms has joined the Harnischfeger Corporation, Milwaukee, as general manager of both Escanaba, Michigan plants where a.c. arc welders and truck cranes are manufactured.

—o—

W. H. Eisenman, managing director of both the National and Western Metal Shows, has announced the appointment of **Mulford L. Cass** to the executive staff of the expositions. Mr. Cass will devote his entire time to Metal Show planning and operation from the national headquarters for the American Society for Metals.

—o—

W. P. Kirk, who on October 31, 1950, retired as vice president of Pratt & Whitney, Division of Niles-Bement-Pond Co., Hartford, Conn., has not announced his future plans, Until further notice, Mr. Kirk's address will be his residence, 60 Beverly Rd., West Hartford, Connecticut.

R. S. Koroncai, general sales manager of Cleveland Industrial Tool Co., Cleveland, Ohio, manufacturer of solid copper diamond tools and hydraulic diamond turners, has announced the opening of the firm's **Michigan Sales Division** at 10526 Grand River Avenue, Detroit. **C. A. Hubley** has been appointed manager of the new division and **Ken C. Boalen** a field engineer.

the "POCKET SIZE MACHINE SHOP"

DREMEL MODEL 2 MOTO-TOOL KIT

Moto-Tool Kit No. 2 contains 23 accessories, including *high speed steel* cutters and Model 2 Moto-Tool in natural finish hardwood case **$23.50**

Moto-Tool No. 2, with one emery point **$16.50**

For burring and grinding parts; grinding and polishing dies; marking tools; sharpening cutters—for these and many other operations, the Dremel Moto-Tool is speeding production and saving labor in industries—large and small. Moto-Tool has oil-sealed bearings for long life, dynamically balanced armature for vibrationless operation . . . delivers 27,000 r.p.m., yet weighs only 13 oz. If your mill supply dealer cannot supply you, please write us.

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IF YOUR MILL SUPPLY DEALER CANNOT SUPPLY YOU, WRITE THE FACTORY

Did You Know That ---

As a result of wide interest in the variety of applications of "Dy-Chek," the dye penetrant method of inspection, the **Dy-Chek Co.**, 1515 E. Broadway, Hawthorne, Calif., has established the Dy-Chek "Inspection Clinic" monthly letters to provide an interchange of technical information and "shop talk."

Chicago-Latrobe, manufacturer of twist drills, reamers, and special tools, has announced that **Bernard Stapp** has joined its sales organization as a district manager to cover the south central territory, which comprises the states of Texas, Oklahoma, Arkansas, Louisiana, and Mississippi. Mr. Stapp will have his headquarters in Fort Worth. His predecessor in the area, **Victor E. Griffin**, has been transferred to the Michigan industrial territory and will be in charge of that territory, with headquarters in Detroit.

—o—

The Taft-Pierce Manufacturing Company has announced the appointment of the **Gottsman Mchry. Co.**, 2457 Woodward Ave., Detroit, Mich., as its exclusive representative for machine tools in Detroit, Toledo, and the eastern half of Michigan. Sales of Taft-Pierce gages and small tools will continue to be handled directly through the company's branch office at 10700 Puritan Ave., Detroit, Michigan.

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SAVE PRESS DOWN TIME WITH
pivot* the world's most dependable punches
• STRAIGHTGROUND
• WHIPSLEEVE SUPPORTED
• HIGH SPEED STEEL
FREE Catalog and Price List. Write for your copy
Dept. 5
PIONEERS IN HIGH SPEED STEEL PUNCHES
pivot punch and die corporation

Did You Know That ---

H. F. Seymour, president of The Columbian Vise & Mfg. Co., Cleveland, Ohio, has announced that **Dan C. Swander, Jr.,** in addition to his duties as vice president, has been made sales manager of that organization.

—o—

Morse Twist Drill & Machine Co., New Bedford, Mass., has announced the appointment of **D. F. Duff,** formerly Morse representative in Cleveland, as district manager of Ohio and Indiana. Morse is now represented in Mr. Duff's territory by **A. E. Boot** and **Harold Symes.**

—o—

George L. Bachner, president of Powdered Metal Products Corporation of America, has been appointed industrial consultant to the chief of ordnance, U. S. Army. In an advisory capacity, Mr. Bachner will head a committee to pass on the suitability of powdered metal fabrication for specific ordnance requirements.

To provide improved service and sales engineering advice, George K. Garrett Co., Inc., Philadelphia, Pa., manufacturer of lock washers, flat washers, hose clamps, retainer rings, springs, and stampings, has moved its Detroit branch to the company's own building at 15755 James Couzens, Detroit 21, Mich. The Detroit branch is under the direction of **J. A. Cotter,** new district sales manager.

Skin Irritations

EFFICIENCY IS SKIN DEEP

You can't expect top production efficiency when *skin irritations* plague your plant workers—causing *absenteeism* and *slow-downs*. TARBONIS has a long record in hundreds of plants for overcoming and guarding against the recurrence of *skin irritations*.

COMMON SKIN IRRITANTS
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- Lime
- Metal Dust
- Urea and Phenol
- Plastic Compounds
- Naphtha
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Did You Know That ---

Joseph F. Eckel, manager of the General Electric River Works, Lynn, Mass., has been appointed manager of the company's large motor and generator divisions at Schenectady, N. Y., succeeding **J. M. Crawford** who has been transferred to Pittsfield, Massachusetts, as manager of the transformer and allied product divisions.

Herbert L. Ross, formerly manager of manufacturing of the G-E Meter and Instrument Divisions, has been named to succeed Mr. Eckel as River Works manager.

—o—

The Carpenter Steel Company has announced the appointment of **Harold R. Potter** as sales manager for the Cleveland district with headquarters in Cleveland, Ohio. He succeeds **James S. Bailey,** who has been named assistant to the vice president in charge of sales to devote his time to special work.

—o—

James William Brooks has assumed sales and engineering responsibilities for The Lincoln Electric Company in the Indianapolis district. **Thomas L. Dempsey** has been added to the staff of the Lincoln Electric Cleveland sales organization as a special field engineer. **John F. Kotchian** is now serving industrial accounts for Lincoln as a welding engineer in the company's Chicago district.

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DIALS · NAMEPLATES
the Only PORTABLE ENGRAVER WITH THESE FEATURES
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PORTABLE ENGRAVER described in Folder 1M27
HEAVY DUTY ENGRAVER described in Folder H27
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Did You Know That ---

Wilbur R. Leopold has been appointed assistant to vice president T. Cruthers of Worthington Pump & Machinery Corp., Harrison, N. J., and will function on public works projects.

—o—

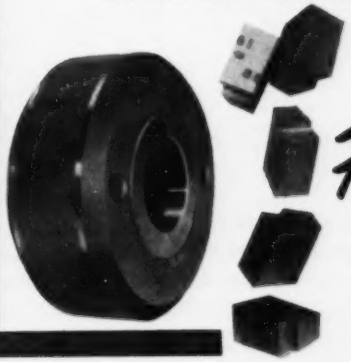
Charles H. Besly and Company, manufacturer of taps, twist drills, reamers, and grinding machinery, has appointed **Ellis C. Wester** as sales manager of its cutting tool division and **Hal Seger** as manager of drill and reamer sales. Both men will work from Besly's Chicago office at 118 N. Clinton Street.

—o—

Arthur H. Lauder has been appointed manager of engineering of General Electric's large motor and generator divisions at Schenectady, New York. Mr. Lauder, who joined G. E. in 1922, succeeds the late Earl S. Henningsen, who died recently after 38 years of service with the company.

Walter C. Foote has been appointed sales manager of the Dearborn Gage Co., Dearborn, Mich. With an extensive background in both engineering and sales, Mr. Foote will assume active direction of his company's expansion program for the distribution and sales of chromium plated gage blocks and other allied equipment.

BUILT-IN MARKING DIE



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WITH PARKER'S INTERCHANGEABLE SEGMENT ROLL MARKING DIE

- One roll marking die to tackle the exacting job of marking thousands of carpenter's squares. Clear accurate lettering was just as sharp for the 1000th impression as for the first. Individual segments can be removed, changed or replaced in seconds. One Parker Roll Die does the job of dozens of solid roll dies.
- The *flexibility* of Parker's Patented Taper Lock roll marking dies is solving difficult marking problems — saving down-time — saving money — every hour, every day for cost-conscious progressive manufacturers. This is but one of the exclusive Parker marking dies.
- For a better mark on *your* product, faster, cleaner, and at less production cost — investigate the *flexibility* of Parker's facilities. From stock marking numbers to specially engineered marking devices. Mechanical engraving and embossing. Parker marking dies for steel, brass, aluminum, plastic or wood.

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Steel Stamps, Marking Dies, Coining Dies, Embossing Dies, Mechanical Engraving and Special Marking Projects. Be sure to have the *Parker Blue Book* in your file.

THE PARKER STAMP WORKS, INC.
MARKING DIE ENGINEERS
FRANKLIN AVENUE • HARTFORD, CONNECTICUT

by Parker

Did You Know That ---

The Hartford Special Machinery Co., Hartford, Conn., has announced the appointment of **Robert A. Bode** as sales manager and **J. James Tasillo** as assistant sales manager for its complete line of products.

—o—

William T. Welch, chairman and president of Ajax Flexible Coupling Co., Inc., Westfield, N. Y., has announced the election of **Wayne Belden** as executive vice president and **Charles Belden** as vice president. **Robert G. Cady** has been made sales manager.

—o—

Lawrence M. Rich has been appointed vice president and general sales manager of the Plomb Tool Co., Los Angeles, Calif. In his new capacity, Mr. Rich will direct all sales and related activities for "Proto" tools and will also supervise the sales operations of the company's subsidiaries.

—o—

The Weldon Tool Co., Cleveland, Ohio, has announced the appointment of **Harris Pump and Supply Company** as its Pittsburgh distributor.

—o—

To fill the vacancy left by the sudden passing of Harry V. Snyder, Manhattan's factory manager, the following new appointments for the Manhattan Rubber Div., Passaic, N. J., have been announced by J. H. Matthews, vice president, Raybestos-Manhattan, Incorporated: **R. J. Gorecki,** factory manager; **W. E. Perkins,** assistant factory manager; **D. J. Fenelon,** director of labor relations; **R. Griffith,** personnel manager; **J. Freeland,** manager cord belt department; and **A. P. Schneider,** superintendent cord belt department.

THREE U. S. Army Ordnance inspectors examine construction, workmanship and materials, both inside and out, during the final inspection operation in the manufacture of 57 mm. recoilless rifles at The Firestone Tire & Rubber Company. K. I. Moore (left) inserts a dummy shell to check for specified firing-pin protrusion and mechanical extraction of empty case. Inspector George P. Gee (center) operates a star gage to measure the lands and grooves of the rifling inside the barrel, and inspector Charles Beatty (right) uses a borescope to check the inside of the barrel for defects. A production record was established by Firestone by producing 300 of these needed weapons in thirty days to meet army needs for the weapon in Korea.

"ALL-WAY" LEVEL

The Fell Precision Level shows the level of all directions at once to an accuracy of .0005 inch per foot. It saves time in the manufacture and maintenance of machinery. Made in sizes 3½" x 6" and 5½" x 12", also 4" and 5" dia. for permanent mounting.

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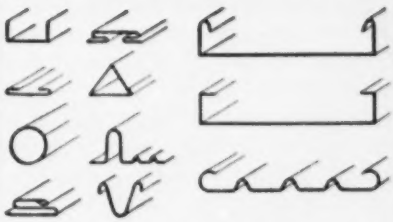

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The CLARK gives you accurate results for every production requirement. It is durably built to give you years of dependable service. It is fast and simple to operate; easy to maintain. Compare the CLARK and see for yourself how much more it has to offer.

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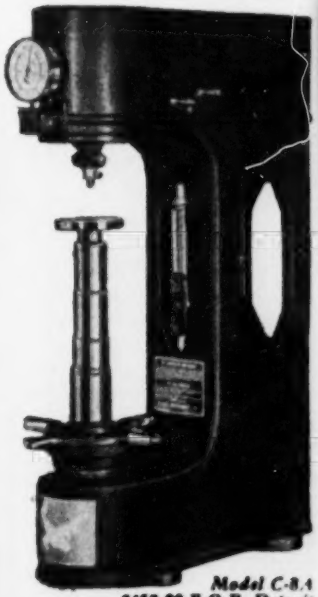

Model C-8A
$450.00 F.O.B. Detroit
Complete with diamond penetrator

Book Reviews

Tool Engineers Handbook (American Society of Tool Engineers). Frank W. Wilson, Editor-in-Chief. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. 2,150 pages. Over 1,500 illustrations. Cloth binding. Price, $15.00.

An authoritative reference on all phases of planning, control, design, tooling, and operations in the mechanical manufacturing industries, this handbook, written for tool engineers by tool engineers and all others concerned with the production of industrial and consumer goods, covers the complete manufacturing operation, including everything from product design and cost estimating through the economical selection of machines, processes and tools to the analysis and improvement of setups and operations.

Arranged to provide the reader with the answers he desires in the shortest possible time, the book covers such major subjects as planning and control of production, inspection, and quality; materials and machinability; casting and extruding operations; metal cutting; grinding; finishing; welding, gluing, and mechanical joining of materials; surface finish and protective coatings; peening; balancing; gaging; inspecting; testing; fixture, die and tool design; limited-production tooling; machine tool controls and feeding devices; design of threads, gears, bearings, springs, and other elements; mathematics; physics, and so on. Each of the above general topics is divided into smaller units and each of these small, specialized topics is explained in detail by an authority in the field.

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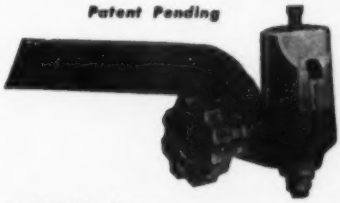
Patent Pending



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Deep characters, carefully engraved, assure maximum legibility with a minimum of effort.

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the handbook includes helpful material drawn from the pooled experience of almost 18,000 A. S. T. E. members, such as sketches of jigs, fixtures, dies, and self-devised small tools, as well as graphs, drawings, diagrams, and sheets taken from company manuals. Hundreds of tables, charts, keyed diagrams, symbols, definitions, equations, and so on, are contained in the book, which was written by 144 authorities in the field.

Coordination Between Engineering, Production and Sales (Production Series No. 193). Published by American Management Association, 330 W. 42nd St., New York 18, N. Y. 24 pages. Paper covers. Price, 50 cents.

Included in this booklet are papers which were presented at the Production Conference of the American Management Association held in New York City on April 3-5, 1950. The papers are entitled "Management Control for Efficient Production Organization," by Thomas J. McGinnis; "How Can Production, Sales and Engineering Coordinate Functions?"—A Panel Session: Introduction by Edward K. Foster; and "Policy, Plans, and Practice in Expanding Plant Facilities," by A. B. Dick, Jr.

Psychology of Safety in Supervision (a series of six training booklets). By Dr. J. L. Rosenstein. Published by National Safety Council, 425 N. Michigan Ave., Chicago, 11, Ill. Price (to members of National Safety Council), 90 cents per set in quantities 1 to 9, 85 cents per set is quantities 10 to 99, 80 cents per set in quantities of 100 to 999, and 75 cents per set for 1000 or

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The Luma combination etchtool and demagnetizer, etches, demagnetizes, anneals and solders. Permanently marks hardest steel with ease of a pencil. Write for complete information.

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1951

CURTIS UNIVERSAL JOINT CO., INC., 10 Birnie Avenue, SPRINGFIELD, MASSACHUSETTS

more; prices to non-members are double those listed.

The first booklet in this series of new training aids for foremen and supervisors is titled "You Can't Change Human Nature" and discusses common peculiarities of human nature and explains why no one is perfect. "What is Your U. Q?" is the title of the second booklet which explains the meaning and importance of a supervisor's understanding quotient or his ability to understand the attitudes and actions of his workers. "Teaching Safety on the Job," the third booklet in the series, describes accidents that happened because workers lacked sufficient knowledge or skill, and discusses supervisory training methods required to prevent such accidents.

"People Act Alike," the fourth booklet, explains in what way normal people are alike and in what way they differ from one another. It discusses basic human wants and explains how supervisors can satisfy these wants. "Safety Takes Teamwork," the fifth of the series, suggests methods for supervisors to make safety interesting and important to workers. "You Are Human Too," the last of the series, provides supervisors a hypothetical measuring stick for determining their own strong points and weaknesses and shows them how to evaluate their habits, emotional biases, and abilities as supervisors.

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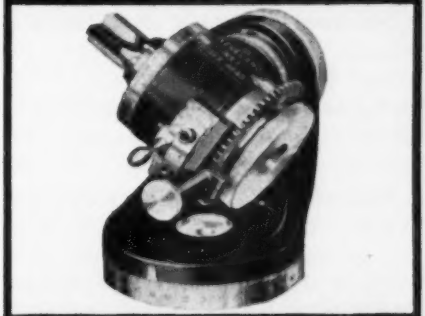
TOOL HOLDER
INDEXING HEADS



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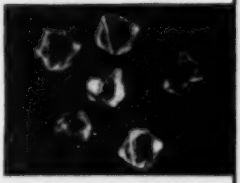

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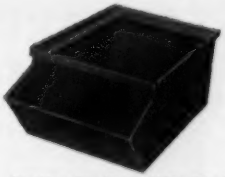

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Sterling Factory Equipment Co., 183 Charles St., Providence, R. I.

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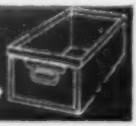

The Human Relations Job of Personnel Management (Personnel Series No. 132). Published by American Management Association, 330 W. 42nd St., New York 18, N. Y. 40 pages. Paper covers. Price, 75 cents.

Contained in this booklet are several papers which were presented at the Personnel Conference of the American Management Association held in Chicago on February 13-15, 1950. Titles of the papers are as follows: "Profits and People: The Personnel Function of Management," by Charles R. Hook, Jr.; "A Management Approach to the Problems of Individual Adjustment," by Allen B. Gates; Developing an Employee-Activities Program," by W. H. Edmund; and "Fashions, Fallacies and Fundamentals," by Garret L. Bergen.

Manual of Welding Engineering and Design. Published by Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y. 43 pages. Illustrated. Heavy paper covers.

The first in a series of free technical handbooks on the latest developments in welding materials and techniques, this manual was published in response to the wide demand for details on the newest advances in welding alloys with special reference to applications for defense production and maintenance. In addition to technical data on characteristics, properties, applications, and operational procedures for welding alloys and fluxes, the manual contains in compact, handy form helpful information on the art of welding in all of its phases.

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sponse to the nation's defense needs, the manual is being made available without charge to individuals writing to the Technical Information Service, Eutectic Alloys Corp., 40 Worth St., New York 13, New York.

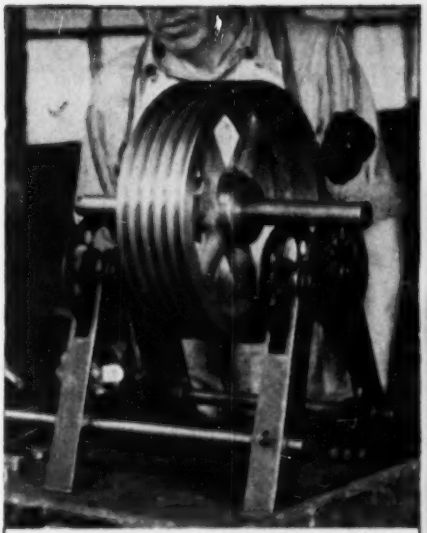
Controlling Indirect Labor and Maintenance Costs (Production Series No. 194). Published by American Management Association, 330 W. 42nd St., New York 18, N. Y. 22 pages. Paper covers. Price, 50 cents.

This booklet comprises papers presented at the Production Conference of the American Management Association held in New York City on April 3-5, 1950. Titles of the papers are "Work Measurement and Incentives for Indirect Labor," by Harold Engstrom; "Developing a Maintenance Program Geared to Company Needs," by Matthew A. Cavanaugh; "Foreman Participation in Problems of Management," by Elliott I. Petersen; and "A Program of Tested Human Relations Principles for Production," by Earl G. Planty.

Correction

In the item "Automatic Loading Reduces Time on Flame Hardening Operation" which appeared on page 243 of the November issue, the rate of production is 100 camshafts per hour per Flamatic machine and not 10 as stated.

For further information on any product mentioned in this issue—use the READER SERVICE CARDS between the covers.



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Our complete line of sensitive balancing tools includes eight different sizes and types. They are widely used on automobile tires, cotton gin brushes, crankshafts, flywheels, cones, pulleys, polishing wheels and other products. You'll find the balancing tool best suited to *your* work in this line of eight different sizes and types.

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21 in.	20 in.	800 lbs.
43 in.	29 in.	800 lbs.
43 in.	29 in.	2,000 lbs.
8 ft.	5 ft.	5,000 lbs.
8 ft.	8 ft.	10,000 lbs.
Any	Any	24,000 lbs.
43 in.	30 in.	800 lbs.

FREE DATA

You can obtain complete information on Sundstrand Balancing Tools by writing for bulletin No. 504.

Sundstrand Machine Tool Co.
2539 Eleventh St., Rockford, Ill., U.S.A.

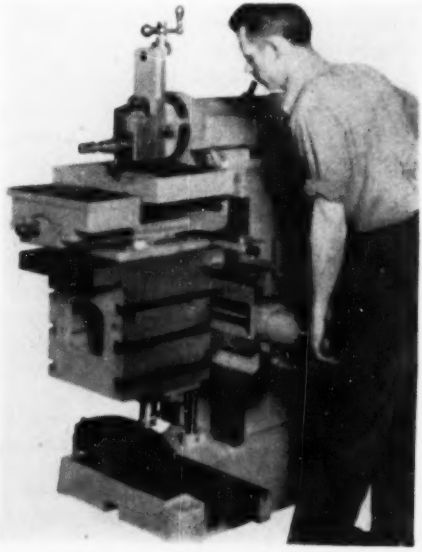
New Shop Equipment

Follower Type Shaper

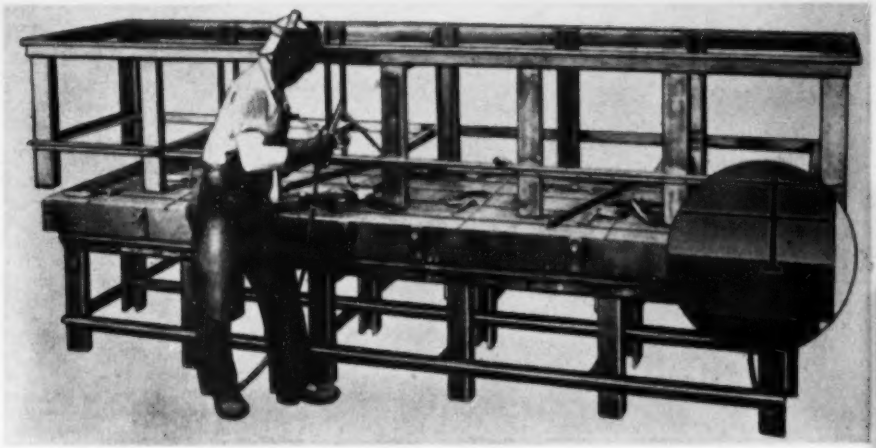
A follower type shaper for duplicating contours on metal parts has been brought out by The Cincinnati Shaper Co., Cincinnati 25, Ohio. The machine illustrated is used for automatically shaping contours on dies, clamps, cams and other parts.

The follower equipment can be supplied on any stroke or size of Cincinnati shaper. The shaper is a standard machine except for the pad on the base, the masterform holder and a special table support post. It can be used for regular shaper work as well as automatic duplicating. Changeover is simple and quick. The rail elevating screw is disconnected and retracted when duplicating so that the table and rail are free to move vertically. The rail and table are supported on the masterform by the steel support post equipped with a roller. The masterform to be duplicated is made of ½-inch steel and clamped in the holder that is secured to the pad on the base. The table progresses horizontally by automatic feed. The table, rail, and work follow the vertical and horizontal movement of the roller as it travels over the masterform.

Cincinnati shapers may be equipped with other types of duplicating followers for more intricate contours or shapes.



Cincinnati Follower Type Shaper in use



Challenge Welding Table

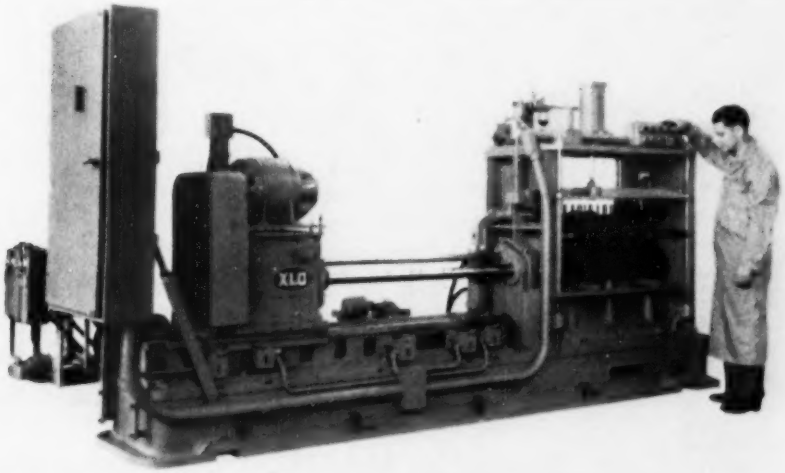
Welding Table

The Challenge Machinery Co., Grand Haven, Mich., has announced a welding table constructed of fine-grain special-analysis semi-steel to provide a rigid, smooth, and square surface for assembling, locating, and welding operations. The table, which is provided with T-slots, is 6 inches thick and is available in 30 x 60-inch, 48 x 96-inch, and 54 x 144-inch sizes.

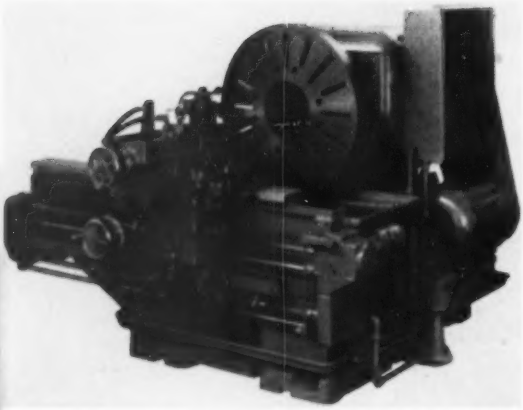
The welding table is supplied with an arc-welded all-steel stand which provides a substantial base that is equipped with screws which enable the user to level the plate quickly and lock it securely.

Line Boring Machine

On the Ex-Cell-O Line Boring Machine illustrated herewith, product of Ex-Cell-O Corp., Detroit 32, Mich., crankshaft and



Ex-Cell-O Line Boring Machine for engine blocks



Lodge & Shipley 60-inch Right-Angle Chucking Lathe

camshaft bearings of engine blocks can be precision line bored simultaneously to extremely close tolerances in an automatic cycle. The operator merely pushes the blocks into the fixture, presses the start cycle button, and then removes the blocks at the completion of the cycle. Net production is said to range from 25 to 35 blocks per hour, depending upon the particular job. The tools for the respective bores are held in solid boring bars, rigidly supported for accurate bearing alignment.

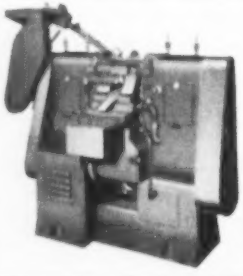
Right-Angle Chucking Lathe Particularly Adapted to Machining Thin-Walled Sections

Product of The Lodge & Shipley Co., Cincinnati 25, Ohio, the 60-inch right-angle chucking lathe illustrated herewith is particularly designed for facing, turning, and boring thin-walled section work of large diameter and short length. An outstanding feature of the machine is the T-shaped bed. The section of the bed carrying the carriage is at right angles to the center line of the lathe; thus, facing at right angles to the center line can be performed by movement of the carriage. Facing in and out a total of 31 inches from the center line to the front of the machine, as well as 6 inches to the back, is said to be readily accomplished.

The top slide is designed so as to have power angular feed in any direction and a total travel of 16 inches; thus, straight or taper boring or turning can be effected. The top slide can be traveled 12 inches in a forward direction and 4 inches to the back.

The headstock of the machine incorporates a large hollow spindle so that workpieces having an extension which will not be machined can be chucked or fixed to a driving fixture in such a way that the workpiece extension can protrude through the hole in the spindle. Much of the work which is adaptable to the lathe may be simply clamped to the faceplate. The lathe, however, is also arranged so that the regular type of headstock may be used instead of the "large hole in spindle" type.

The machine is designed for easy operation and is arranged in such a manner that the operator may readily follow the path of the tool and quickly take required measurements. The operator has full control of all operating functions of the machine at the apron position. Constructed to occupy a minimum of floor space, the lathe has a maximum swing over bed of 60 inches and is provided with 24 spindle speeds. The shipping weight of the unit is approximately 17,700 pounds.



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The KENT *Duplex* DRILLER

Two drills move toward the center. One drill then withdraws and the other completes the hole. Parts can be drilled and countersunk at the same operation. Semi-automatic or full automatic feed. *Write for illustrated descriptive literature.*

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Drillers - Threaders - Slotters - Countersinkers - Bar Pointers

3 times the productive capacity for the same tool investment

Old timers still tend to gauge a machine tool's productive capacity by its size and mass, and its accuracy by its cost. These old "rules" do not apply today, in the face of advanced machine tool engineering and modern machine tool building methods. For example, a modern TS56B Sheldon Precision Lathe, weighing around 1000 lbs., will handle the great bulk of production lathe work, and it has "Zero Precision" Timken Taper Roller Bearings — more accurate spindle bearings than found in 90% of the lathes of all sizes.

By scientific distribution of metal (rather than sheer mass) these new machine tools have rigidity and stamina not always obtained in more cumbersome machine tools. Lighter, handier and easier to run, they can be safely operated by the less experienced—by whatever operators available.

Produced in numbers, in a specially built and tooled plant, Sheldon Precision Machine Tools are low in price. Today for the cost of a single older type tool you can have 2, 3 or even 4 SHELDON units . . . can put 2, 3 or 4 operators to work . . . can double or triple your productive capacity for the same machine tool investment. *Let us show you how.*

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CHICAGO

SHELDON MACHINE CO., INC. • 4250 N. Knox Ave., Chicago 41, Ill.

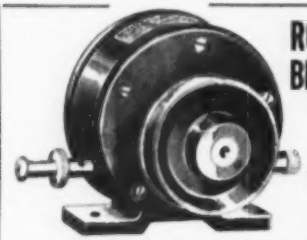
Press Drills to Center of 14¼-Inch Circle

A 14-inch drill press, known as the "Economy Model" and available in either a floor or bench type is now being produced by the South Bend Lathe Works, South Bend 22, Ind. The press is said to have a capacity for drilling to the center of a 14¼-inch circle, a maximum drill size of ½-inch in steel, and a spindle runout of 0.005 inch. A vertical mounting ⅓ or ½-h.p. 1,725-r.p.m. motor may be used to provide four spindle speeds ranging from 740 to 4,070 r.p.m.

An automatic belt tension device maintains proper tension on the motor belt, and spring tension helps absorb shock if the drill should catch in the workpiece.

South Bend 14-Inch "Economy Model" Drill Press

Table surfaces and the base surface of the bench model are precision ground and slotted. The table has a ¾-inch thick edge rib to provide for clamping of work. Various accessories, such as a table vise, fully enclosed belt guards, straight shank spindle, bench, multi-speed attachment, and so on, are available.



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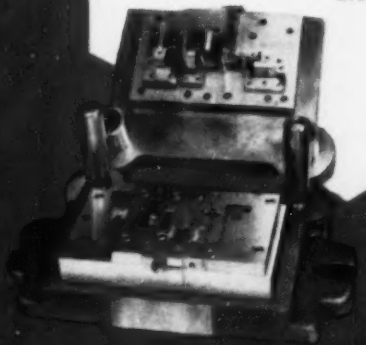

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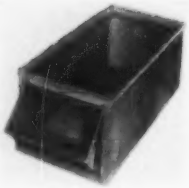
Shop Box



Lyon Style RB Shop Box

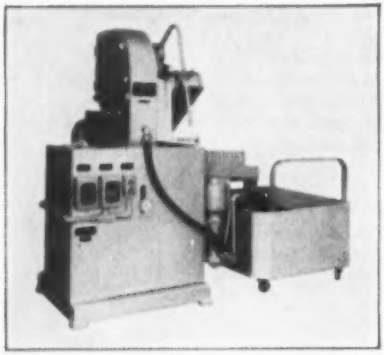
Lyon Metal Products, Inc., 1138 Monroe Ave., Aurora, Ill., is now manufacturing a steel shop box for use in all types of shops, stockrooms, assembly lines, and industrial plants. The box is available in five different styles, including the Style RB illustrated herewith, which can be stacked on the floor and used for regular bin type storage. The hopper end permits easy removal of contents from boxes even when stacked. The front top rail is rounded for use as a handle. The opposite end has a drop handle. The box is 10 inches wide x 20 inches long x 8 inches high and is available with a green finish or without any finish.

Inclinable Press

Identified as the "Press-Rite" No. 1½, a 15-ton open back inclinable press of single-stroke design and having a sliding key clutch with a 4-point engagement ring and roller bearing mounted flywheel has been placed on the market by Sales Service Machine Tool Co., 2363 University Ave., St. Paul 4, Minn. The press has a standard stroke of 2 inches, with longer strokes up to 3 inches available if required, and features V-ways on its ram with triple lubrication. The unit has a 5½-inch throat depth, occupies a 23 x 26-inch floor space, and weighs 110 lb. (less motor).

"Press-Rite" No. 1½ Inclinable Press

CUTTING.. New Campbell Abrasive Cutter designed for economy



Model 223 Campbell wet abrasive cutting machine will cut up to 2" solid bar stock; up to 3½" tubing. Material may be steel of any analysis—annealed or unannealed—brass, bronze, monel, and phenolic plastics. Cuts are made to a tolerance of a few thousandths, smooth, clean, with practically no burr or burn.

This new Campbell machine is designed for better coolant distribution, faster cutting, longer wheel life: in short, more economical cutting. And through manufacturing economies, it can be produced and sold at a lower price than previous comparable machines.

Very often abrasive cutting is the one best solution to a production problem. For further information about this and other Campbell Abrasive Cutters, write us.

CAMPBELL MACHINE DIVISION

American Chain & Cable
931 Connecticut Avenue
Bridgeport, Conn.

PRODUCTION goes up

SPOILAGE goes down

with this Procunier High Speed Tap Head

The exclusive Procunier "Tru-Grip" tap holder is lighter, smaller in diameter. It affords easier tapping close to walls or shoulders, eliminates "chewed" tap shanks. Holds tap true.

Exclusive! PROCUNIER "Tap Saver"

Today you must **speed** up your **production schedules** . . . and at the same time **reduce spoilage!** The Procunier High Speed Tapping Head is precision-built for faster, consistently accurate production tapping. A host of exclusive Procunier feature enables you to maintain cleaner, sharper threads . . . with fewer broken taps, fewer spoiled pieces—even on accelerated production runs.

HERE'S WHY: Tap driving pressure is **automatically regulated** by the amount of pressure applied to the unique Procunier friction clutch. Operators quickly learn to detect dull or "loaded" taps just by the pressure needed to drive them! This increased sensitivity enables even "green" operators to do more accurate tapping. "Blind" hole tapping may be done as easily as through tapping! WRITE TODAY for brochure giving full details and specifications on Procunier High Speed Tap Heads. Also Available—**NEW! Procunier "TAP KING"** for **large hole** tapping. Capacity 3/8" to 1" in steel; 1 1/8" in softer metals.

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Gentlemen:

Please send your illustrated brochure giving complete details, specifications and prices on the improved line of Procunier High Speed Tapping Heads.

Name .....

Address .....

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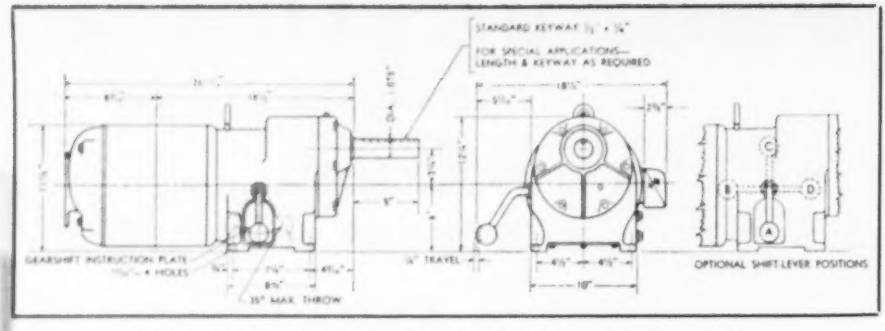


Drawing showing dimensions and optional shift-lever positions of Lima Type R3AC Gearshift Drive

Gearshift Drive

Designated as the Type R3AC, a 5-h.p. 1,200-r.p.m. selective-speed gearshift drive designed to individually motorize and drive machinery of various types that require a low range of selective operating speeds combined with high radial load capacity has been announced by The Lima Electric Motor Co., Dept. AB5, Lima, Ohio. Incorporating both primary and secondary gear reductions, the drive is a compact combination of a 5-h.p. 1,200-r.p.m. integrally-mounted electric motor and a four-speed sliding gear transmission, providing a choice of output speed combinations ranging from 123 to 1,140 revolutions per minute.

Overall dimensions of the Type R3AC, including a standard 5-inch output shaft extension and gearshift lever, are 31 1/16 inches long x 12¼ inches high x 18¼ inches wide. The drive is designed to operate on polyphase, a.c. power supplies of standard frequencies.

A BETTER BORING BAR

OUR fine list of Customers is PROOF that our method of broaching square holes makes a better fit for the tool bit. This means more rigidity and longer life especially with tungsten Carbide. We also make bars for our Type B and Type C cutters or a combination of tool bits and cutters. Bars are made to suit customers' requirements as to method of drive, pilot, number of holes, angle of bit, etc. Our two-bladed cutters can be floated in the bar or held rigidly. Cutters are interchangeable—hence can be ground in an arbor in the tool room and only require a few seconds for inserting in the bar.

Square hole sizes range from ⅛" up to and including ¾".

THE DETROIT BORING BAR CO.

688 E. FORT ST. Detroit 26, Mich.

Established *1927*

TYPE "B" AND "C" CUTTERS

Suitable for Tipping With Tungsten Carbide

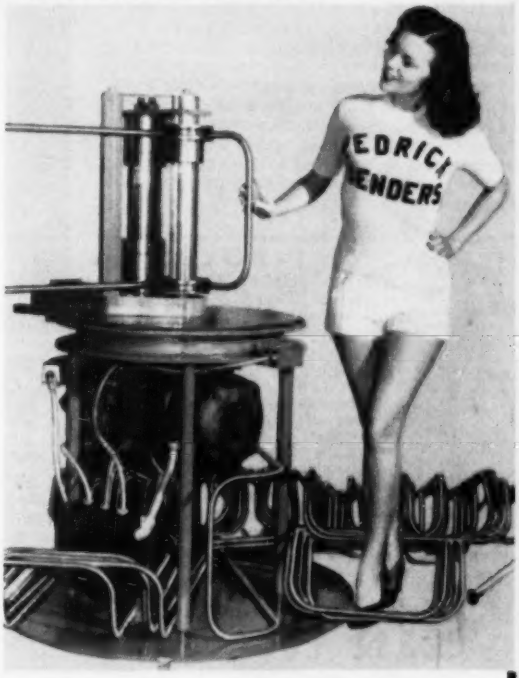
"B" A strong rigid serrated 2-bladed cutter—located in the bar with a taper pin. Bores holes accurately to close limits. Can be expanded and reground giving long life. Sizes ⅜" dia. up to 6".

"C" A simple 2-bladed reaming cutter. Can be expanded and reground. Located in the bar by a hardened V. This V never has to be reground as blades are expanded.

Fits other bars with slots
⅜" x ⅜"
½" x 1"
⅝" x 1⅛"
⅞" x 1½".

FIGURES ARE WHAT COUNT

A PEDRICK BENDER costs less to Run



● Pedrick Production Benders have a low first cost. They are inexpensive to run too. An inexperienced girl can produce as much as a journeyman machinist. This is a fact because the machine is semi-automatic. All you have to do is load it, start it and unload it—the machine does the rest. If your job involves an offset bend, as shown in the illustration, both legs may be bent at the same time. This eliminates a difficult jigging problem and a troublesome human factor. Other problems can be met and solved on Pedrick machines with equal ease. The same machine will bend pipe, tubes, strips, shapes and bar stock by merely utilizing suitable dies. This makes a very versatile machine of your bender. It will pay you to investigate it further.

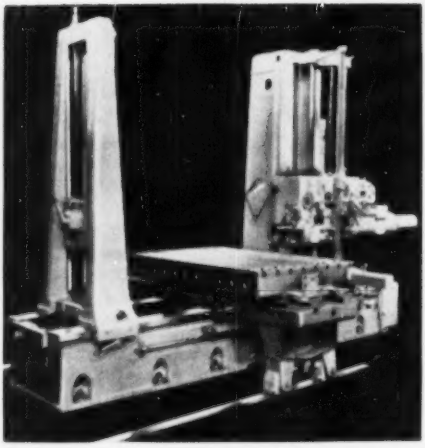
Write for our descriptive folder.

PEDRICK TOOL and MACHINE CO.

3641 N. LAWRENCE STREET **PHILADELPHIA 40, PA.**

Horizontal Boring Machines with Hardened and Ground Ways

According to an announcement by Giddings & Lewis Machine Tool Co., Fond du Lac., Wis., heavy duty surface hardened ways are now available on G. & L. horizontal boring, drilling, and milling machines. The hardened ways are claimed to have unusually long wearing properties obtained as a result of consistent hardness throughout the ways. A new mounting method is said to minimize transmittal to the ways of torque strains and stresses set up by temperature changes. In addition, the way mounting



Hardened ways on this Giddings & Lewis 340-T Horizontal Boring, Drilling and Milling Machine are said to ensure continuous machining accuracy over long periods of time.

tends to compensate for vibration created by other machines located near the G. & L. machine. All ways are precision fitted to their respective mounting surfaces and are said to be held flat and parallel throughout their entire length.

G. & L. horizontal boring, drilling and milling machines are now available with the hardened ways on the bed, saddle, column, and runway. The line includes floor type, table type, and planer type machines in a broad range of sizes.

Metal Band Saw Has 14 x 18-Inch Capacity

W. F. Wells & Sons, North on U. S. 131, Three Rivers, Mich., has announced a metal cutting band saw with capacity of 14 x 18 inches which is designed to meet

WESPO

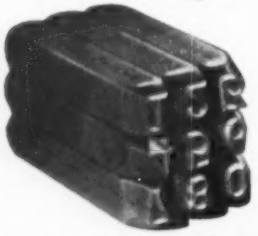
T-BOLTS
HEAT TREATED
HIGH TENSILE STRENGTH

Ea.		Ea.	
½ x 2"	$ .44	⅝ x 3"	$ .57
½ x 3"	.50	¾ x 2"	.66
⅝ x 2"	.51	¾ x 3"	.77
1 x 4"	$1.54 ea.		

Complete Range — to 1 x 22" other dia. to 12". Write for complete price list and quantity discounts.
Immediate Delivery—F.O.B. Det.

WEST POINT MFG. CO.
19625 Merriman Ct. Farmington, Mich.

Why THOR STAMPS Last Longer



. . . because they're made of a special, correctly-heated alloy steel. Central striking point assures uniform marking. Thumb side marking assures easy use.

You get more mark per dollar with THOR STAMPS. Write for catalog and prices.

The Pittsburgh Stamp Co., Inc.
812 CANAL ST. • PITTSBURGH, PA.

All standard sizes carried in stock for immediate delivery. Special cutters made to Blue Print.

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Write today for prices. A few territories open.

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Headless Set Screws

Socket Set Screws

Try Them On Your Next Job!

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6" and 15 mm. scale

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.001" and 0.1 mm vernier

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$9.75

f.o.b. New York

Importer and Mfrs. Agent

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Dept. MMS

381 Fourth Ave., New York 16, N. Y.

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Chandler-Duplex

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NEW! Re-designed! Added Features!

A Boring Head That Won't Face Is NOT Complete

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MUNCIE, INDIANA, U. S. A.

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LONG DRILLS

9" FLUTE
12" HIGH SPEED 12"

Size	Price Each
1/8" x 12"	$1.71
9/64" x 12"	1.71
5/32" x 12"	1.71
11/64" x 12"	1.71
3/16" x 12"	1.71
13/64" x 12"	1.82
7/32" x 12"	1.82
15/64" x 12"	2.00
1/4" x 12"	2.00
17/64" x 12"	2.12
9/32" x 12"	2.12
19/64" x 12"	2.29
5/16" x 12"	2.29
21/64" x 12"	2.59
11/32" x 12"	2.59
23/64" x 12"	2.88
3/8" x 12"	2.88
25/64" x 12"	3.17
13/32" x 12"	3.17
27/64" x 12"	3.47
7/16" x 12"	3.47
29/64" x 12"	3.76
15/32" x 12"	3.76
31/64" x 12"	3.76
1/2" x 12"	3.76

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BARGAIN PRICES

KNOWN FOR THEIR PRECISION AND DEPENDABILITY.

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Carat	Price Complete
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1 1/2	12.00
2	15.00
3	25.00
4	35.00

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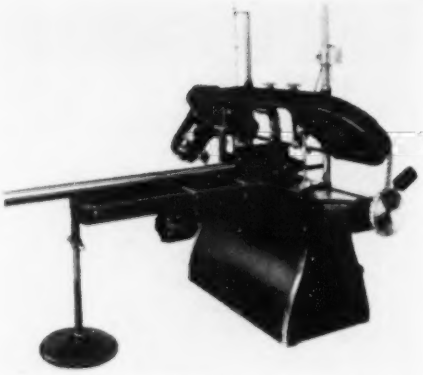
EASTERN TOOL SUPPLY CO.
172 Grand St., N. Y., N. Y.



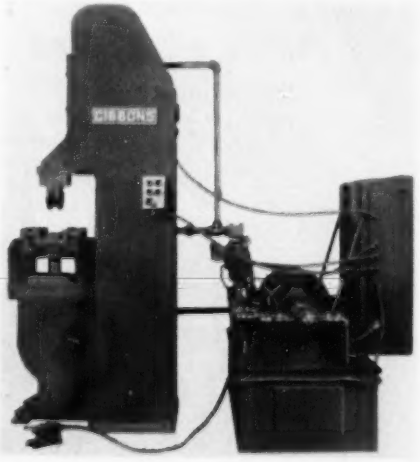
Wells Model D Metal Cutting Band Saw

the requirements of larger cutting jobs. Designated as the Model D, the machine can be used for various milling and planing operations, such as slotting, removing corners of die blocks, and so on.

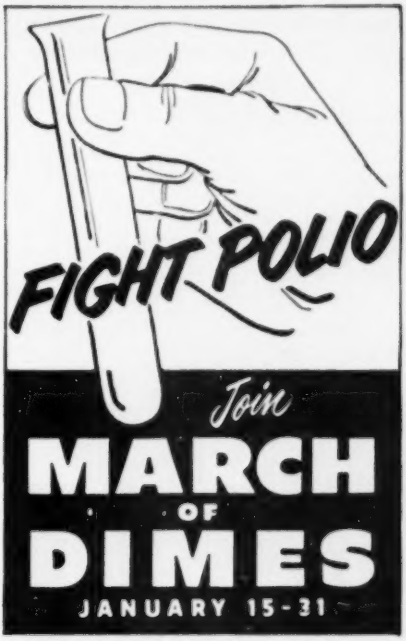
Designed to raise and lower hydraulically, the unit provides cutting speeds of 60, 90, and 120 f. p. m. and has a blade size of 14 feet 5 inches x 1 inch x 0.035 inch. Maximum clearance under the saw blade is 20 inches.

Tube Bending Press

Identified as the Series 200, a hydraulic press especially designed and tooled for tube bending operations has been an-



Gibbons Series 200 Press and oil reservoir



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374,220 PIECES PER GRIND

with WILLEY'S
SOLID CARBIDE REAMER

On this typical valve guide bushing, one man reamed 10,000 pieces per day, manually. Over 374,220 pieces were reamed per grind, with the reamer revolving at 1200 R.P.M.

Actual production reports demonstrate the superior quality of WILLEY'S METAL.

WRITE FOR CATALOG

WILLEY'S CARBIDE TOOL CO.
SOLE MAKERS OF WILLEY'S METAL
1342 W. Vernor Highway Detroit 1, Michigan

nounced by Gibbons Machine Co., 501 N. 5th St., Tipp City, Ohio. The press, which has an operating speed of 20 strokes per minute, includes a multiple positive index stop for various degree bends. The knee width of the machine is 11 inches, thus permitting reverse bends to be made 5½ inches apart.

A rocker die and three sets of rockers and side arms are furnished with hydraulic pressure pad. Also featured is an overhanging type ram which operates in nickel cast iron gibs and permits bending over the top of the punch.

Test Indicator Useful for Laying Out, Checking and Inspecting Workpieces

Designated as the No. 711-E "Last Word," a test indicator which can be used for precise indicating in machining, layout, checking, or inspection operations has been announced by The L. S. Starrett Co., Athol, Mass. A universal swivel friction holder on the end of the body permits using the indicator in the chuck of jig borers, milling machines, or boring machines. A universal shank also supplied can be attached to the end of the friction holder, thus allowing the indicator to be used on 18 and 24-inch vernier height gages, in the tool post holder of a lathe, on milling machines, and various other machine tools.

Starrett No. 711-E "Last-Word" Test Indicator

The indicator has an adjustable dial which 1¾ inch in diameter, a range of 0.030 inch, and is accurately graduated in thousandths of an inch.

Kester Soldering FLUX

Liquid Fluxes—Soldering Salts and Paste

62 DIFFERENT FLUXES to meet Your Requirements

Kester makes a flux for every soldering operation because modern efficiency demands the correct flux for the job. Consult Kester's Technical Department on any flux problem.

Free—Technical Manual, "Solder and Soldering Technique"

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The widespread success of the Payroll Savings Plan is an excellent example of our freedom of thought and independence of action. Far-sighted employers *offered* these 8,000,000 Americans an *opportunity* to enroll in the Payroll Savings Plan. There was no pressure, no emotional stimulation. A Payroll Savings Plan application was placed before them. They "signed up"—to the benefit of themselves, their companies and their country.

Has *every* man and woman in your company been *offered* an opportunity to share in the benefits of the Payroll Savings Plan? Delegate one of your top executives to conduct a person-to-person canvass of your employes. Make sure that *every* man and woman gets an application blank. You don't have to urge them to enroll—they are anxious to build for their own independence.

Get in touch with your State Director, U. S. Treasury Department, Savings Bonds Division. He is ready to help you—with a package plan that reduces your work to the minimum.

The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the G. M. Basford Company and

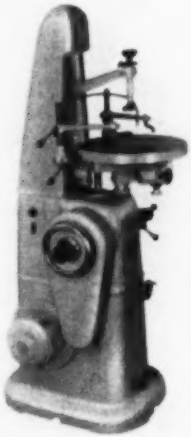
MODERN MACHINE SHOP

Cutting Oils

Three new and improved grades of Gulf Electro Cutting Oils recommended for heavy duty machining operations on ferrous metals and alloys, particularly for low machinability steels, have been introduced by Gulf Oil Corp., 722 Gulf Bldg., Pittsburgh 30, Pa. The oils are described as transparent, highly sulphurized mineral oil containing maximum efficient amounts of highly active sulphur through the use of a special process for sulphurization of mineral oil. The new lighter and brighter color of the oils are said to permit closer inspection of machine parts, and their excellent anti-weld characteristics and extreme load carrying ability are claimed to allow for the use of the oils on heavy duty and difficult machining operations.

Machine Designed for Final Finishing Operations on Punches and Dies

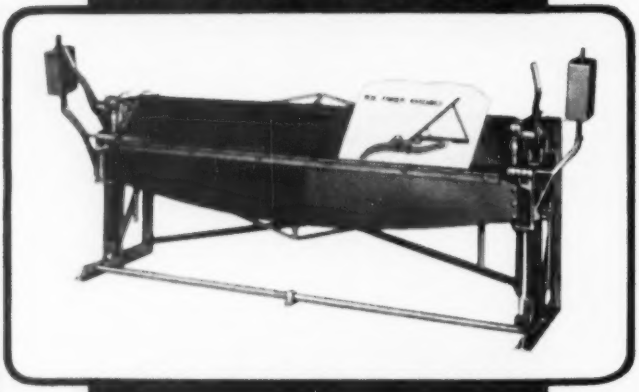
Connecticut Tool & Engineering Co., 544 Iranistan Ave., Bridgeport 5, Conn., has announced the Williams Model F-3 Punch and Die Making Machine



Williams Model F-3 Punch and Die Making Machine

for final finishing operations on metal stamping or power press punches and dies and also on dies for extrusion metals. The machine is shown equipped with a ½ h.p. 1,800 r.p.m. axial air gap motor; however, a flange on the machine base allows for the accommodation of other

WHITNEY METAL
TOOL COMPANY
41 YEARS EXPERIENCE



WHITNEY-JENSEN
ROLLER BEARING
BENDING BRAKES

A modern departure from conventional hand brake design. Work is not limited to straight bending and box and pan work alone. Special attachments permit many intricate forming operations. Made in 16, 14, 12 gauge capacities; 4, 5, 6, 8, and 10-foot sizes.

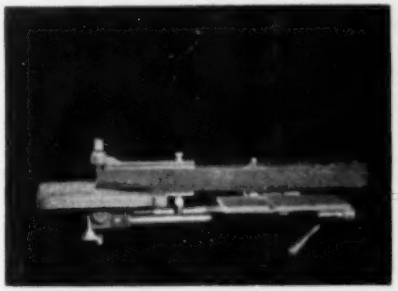
WHITNEY METAL TOOL COMPANY
110 FORBES STREET, ROCKFORD, ILLINOIS

standard horizontal shaft motors. The variable speed transmission is fully enclosed and operated from a conveniently located dial and handle to provide 75 to 350 strokes per minute of the operating shafts.

Additional features include a splash lubricating system for the driving mechanism; handy foot pedal device for instant control of operation; compound tilting table; 5-inch stroke and table adjustment; air pump and piping; adjustable lights, and so on. Attachments for light and heavy compression and tension files, holders and guides for fine or jewelers' saws, and honing or stoning adapters can be furnished.

Contour Grinder for Attachment to Drill Press

George F. Grant Co., Inc., 47 Kempton Place, West Newton, Mass., has announced the Grant Contour Grinder, a precision built grinder which is designed for mounting on a drill press column and can be readily swung out of the way when not in use. Utilizing standard 2½ x 60-inch belts, the grinder can be employed for the complex grinding of concave and convex parts and radii, as well as for deburring, shaping, and numerous other uses. A change of belt ratio or spindle provides speeds ranging from 7,000 to 36,000 r.p.m. A special interchangeable spindle attachment allows for continuous roll form or cylindrical grinding. Other special equipment available includes a spindle grinding attachment accommodating ¾ to 2-inch diameter abrasive sleeves for internal surfaces.

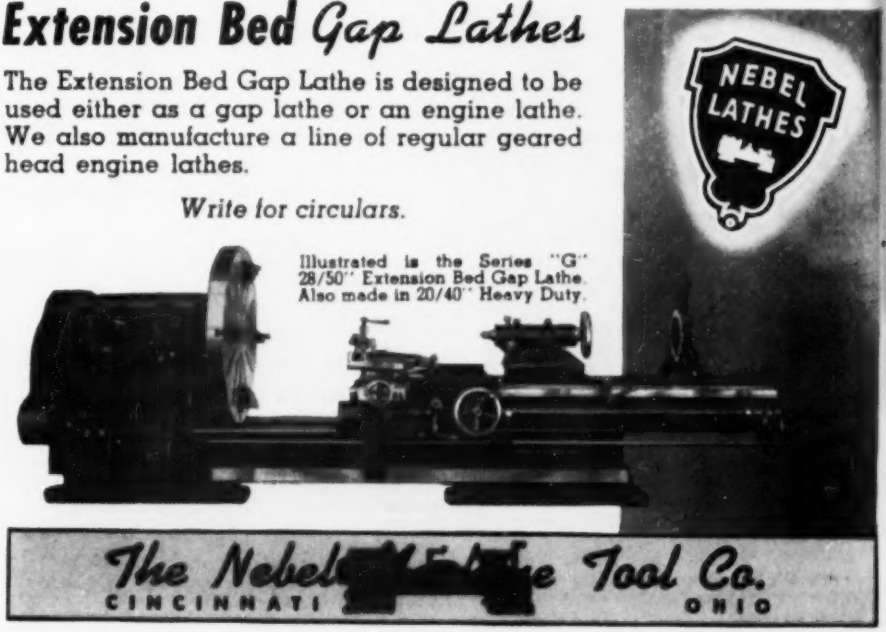


Grant Contour Grinder installed on a drill press

Extension Bed Gap Lathes

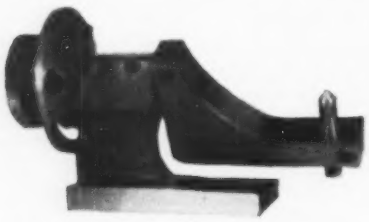
The Extension Bed Gap Lathe is designed to be used either as a gap lathe or an engine lathe. We also manufacture a line of regular geared head engine lathes.

Write for circulars.



Unit Dresses Radii from 1½-Inch Concave to 1½-Inch Convex

Sperman Metal Specialties, 2197 E. 21st St., Brooklyn 29, N. Y., has announced improvements in its "Mighty Midget"



"Mighty Midget" Improved Radius Dresser

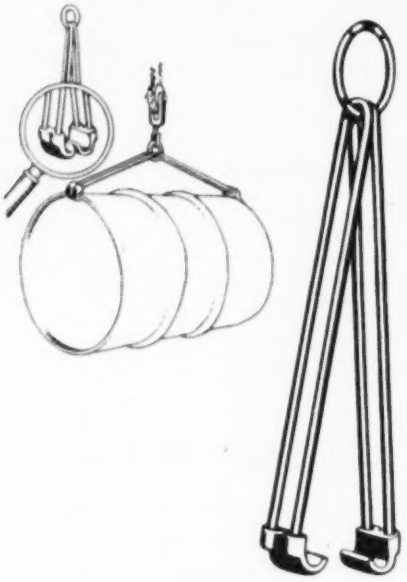
Radius Dresser which provide for an increase in the capacity of the unit by 50 per cent, thus enabling it to be used for dressing radii from 1½-inch concave to 1½-inch convex. Another feature of the improved dresser is the addition of accurate, adjustable, easily-set stops which permit the radius arm to be set so as to stop in any position from 0 to 180 degrees. These features apply to both the 7 and 10-inch wheel sizes in which the dresser is available.

DRILL and PILOT BUSHINGS
Frictionless —Rotary
For core drilling, T. C. and high speed boring, turret tool, piloting, etc. Won't stick or clog. Dust proof as a watch.
Write for details.

GATCO ROTARY BUSHINGS CO.
1300 Mt. Elliott Ave. Detroit, Mich.

Drum Lifting Hook

Morse Mfg. Co., Inc., Dept. MMS, 122 Dickerson St., Syracuse 2, N. Y., has announced improvements in its Model No. 41 Drum Lifting Hook which is now much stronger than before and also much lighter. Designed primarily for lifting steel drums, although it may be used for barrels, the hook consists of double steel rods



Morse Improved Model No. 41 Drum Lifting Hook

and a malleable steel hook with a 3-inch diameter welded ring. Lifting capacity is 1,000 pounds.

RUGGED

"NIROL" LIVE CENTERS permit perfect support of all loads and thrusts. Reduced overhang adds rigidity and increases machine capacity. Compensating factor provided for work expansion from heat while machining. Runs true within .0002" accuracy.
Write for complete details.

L. F. TREICHLER
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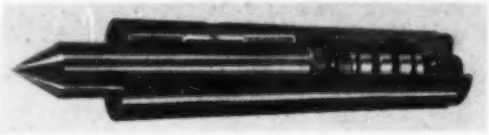
NORTH PLAINFIELD, N. J.

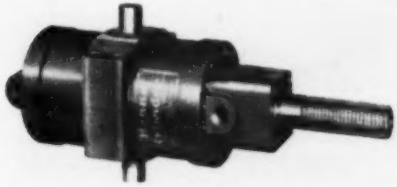
- ***Faster Machining***
- ***No Scored Centers***
- ***Remarkable Accuracy***



Patent Applied for

Hydraulic Cylinder

Designated as the Model HP-17, a high pressure hydraulic cylinder designed for working pressures up to 1,500 p.s.i. has



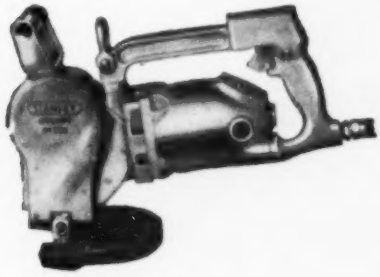
Hanna Model HP-17 Hydraulic Cylinder

been announced by the Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill. The cylinder is said to provide smooth, efficient push, pull, lift, press, clamp, or control power in a wide variety of applications. The Model HP-17 is made in eight standard mounting styles.

Portable Electric Shear

Described as ideal for the straight cutting of sheets on heavy production jobs, as well as for maintenance and repair work, a portable electric shear which is said to cut up to 6 gauge (0.203-inch) steel has been announced by Stanley Electric Tools, 520 Myrtle St., New Britain, Conn. Designated as the No. 206 Unishear, the tool, which is designed to cut at a speed up to 5 feet per minute on straight cuts, has a duplex handle for convenient gripping and can be easily suspended when necessary.

Other features of the shear include full ball bearing construction, heat-treated



Stanley No. 206 Unishear

forged steel yoke, and universal type motor for operation on 115, 230, or 250 volts, either d.c. or a.c., 60 cycles or less.

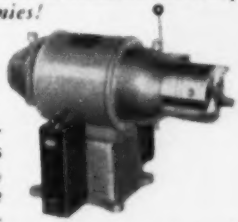
SCHAUER

SPEED LATHES

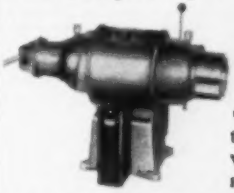
Who Uses Them?

General Electric • Aluminum Co. of America • Studebaker • Thos. A. Edison • Ford Motor • Westinghouse Electric • Owens Illinois Glass • Lockheed Aircraft • Western Gear Works • Bryant Electric • Royal Typewriter • Yale & Towne • Eastern Airlines • Minneapolis Honeywell • Remington Arms • • American Locomotive • American Brass . . . *and several hundred more top drawer companies!*

Why?



Because Schauer Speed Lathes *cut from 30% to 90% off the cost of polishing, filing, lapping or de-burring small metal and plastic parts!*



• Chuck, collet or vacuum holding fixtures.

• Single speed, two-speed or variable speed models.

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SCHAUER MANUFACTURING CORP.

• ORIGINATORS OF TODAY'S SPEED LATHES

2060 Reading Road Cincinnati 2, Ohio

NUMBERALL

CUTS THE COST OF STAMPING NUMBERS

Model 70

Multi-Wheel Numbering Machine

Machine and Shank All One Piece.

The most efficient method of stamping numbers into metal. Repeats the same numbers until changed. Model 70 NUMBERALL Machines are used in all industries to mark various parts. Stamps numbers, etc., quickly . . neatly. Perfectly aligned. Much better marks are produced by these machines than by single stamps or steel type, and at a far lower cost. Shank for Hand or Press and with any number of wheels from 3 to 20.

Write for Bulletin MS-70.

AUTOMATIC INDENTING NUMBERING HEAD • MODEL 50

Automatic indenting numbering head for consecutive or repeat numbering 1/32" to 3/8" high figures can be furnished in sharp face Gothic or shaded Roman figures. Can be used in foot or power presses.

Numbers: radio, airplane, tool parts, name plates, and other objects in brass, steel, fiber, plastics.

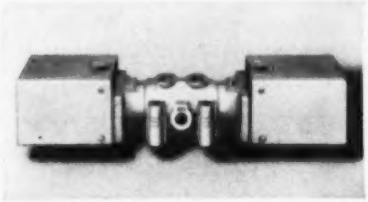
Heads are of sturdy construction and give uninterrupted marking service.

Model 50.

NUMBERALL STAMP & TOOL CO.
HUGUENOT PARK STATEN ISLAND 12, N. Y.

Double Solenoid Hydraulic Valve

Designated as the Series 5500, a double solenoid operated, 4-way hydraulic valve designed for use as a semi-automatic



Rivett Double Solenoid Hydraulic Valve

electric control of a hydraulic circuit with pressures up to 1,500 p.s.i. has been introduced by Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass. Located at each end of the valve body, the two solenoids are of the continuous duty push type. The valve features a hydraulically balanced piston which has an integral spool and stem.

The valve is available in ¼, ⅜, ½, ¾, and 1-inch sizes for standard 110, 220, and 440-volt, 50 or 60-cycle current.

Boring Head

The MB-121 Boring Head illustrated herewith, product of DeVlieg Microbore Co., 450 Fair Ave., Ferndale 20 (Detroit), Mich., is adjustable quickly and accurately by means of a micrometer vernier arrangement. The toolslide can be adjusted in accurate increments from 0 to ¼ inch off center.

With a standard set of boring tools, bores ranging from ¼ to 1 inch in diameter can be machined with the head,

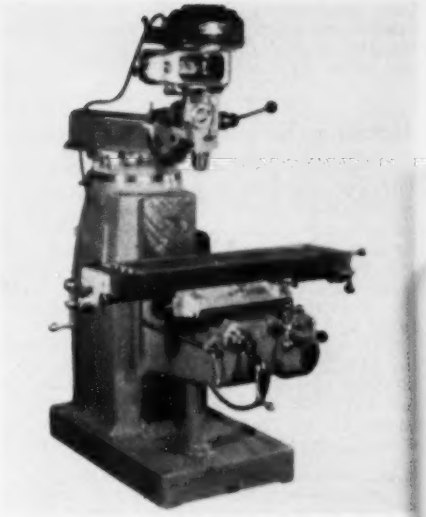
MB-121 Boring Head

which can be furnished with straight, taper, or flanged type shanks to suit practically any make of boring machine.

Miller Features Universal Head

Product of Tree Tool & Die Works, 1600 Junction Ave., Racine, Wis., the Tree 2 UV Universal Vertical Milling Machine illustrated herewith incorporates a 45-degree dovetail column and extended knee construction, as well as a universal vertical head for all-angle milling, drilling, and boring. The vertical head can be moved up to and including 45 degrees across the table each way from a vertical position, thus permitting angular milling cuts to be made the length of the longitudinal table feed without resetting. The head can also be rotated in a plane parallel with the table axis 90 degrees each way. A 1 h.p. axial air-gap motor is provided for powering the spindle at speeds ranging from 140 to 3,500 r.p.m. or from 210 to 5,200 r.p.m.

Mounted on a dovetail type ram which enables the spindle to be moved to any position perpendicular to the table without the necessity of realigning after moving, the head has a capacity for end mills from ⅛ to 1½ inches. An additional feature of the head is an automatic collet closing mechanism for holding tools and cutters without slippage. Other features comprise powered down feed to the quill, enclosed micrometer depth stop, and positive gear lock.



Tree 2 UV Universal Vertical Milling Machine

The machine incorporates a built-in feed box providing five rates of feed and rapid transverse to the longitudinal

IF YOU USE WOOD SAWS

This is it! MANUAL OPERATION

KEEP 'EM SHARP WITH THIS HANCHETT NO. 136 HAND GUMMER AND SHARPENER. Grinds all rip and cross-cut circular saws—6" to 36" diameters. Wide range of uses—gumming, sharpening, jointing—ideal for all plants, job shops, pattern and maintenance departments.

Belt or Motor Drive Attachments extra.

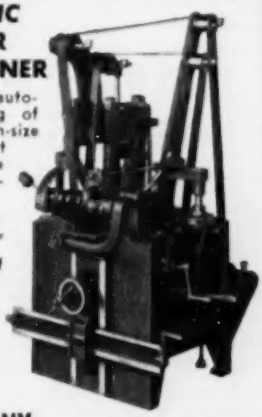
$290 Write Dept. MMS-11 for details

FULL-AUTOMATIC YET LOW IN PRICE!

HANCHETT NUMBER 724 AUTOMATIC CIRCULAR SAW SHARPENER

For low-cost, full-automatic sharpening of small and medium-size rip and cross-cut saws. Check these production features:

- Accurate Action
- New Mechanism, controls bevel grind on cut-off teeth
- Double Slide Head, vertical—horizontal.
- Adjustable Tooth Cam



COVEL SAW SHARPENERS · HANCHETT KNIFE GRINDERS

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Main Office: Big Rapids, Mich.

West Coast: Portland, Ore.

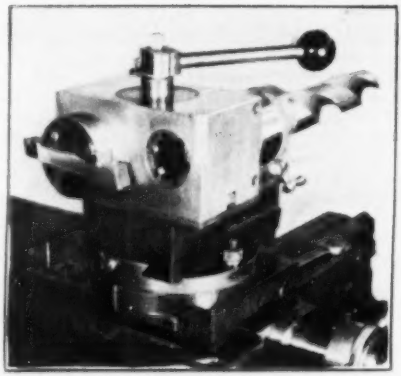
For rip and cross-cut saws from 6" to 36" diameter.

table movement. The feed drive to the table is effected through a safety device to prevent damage to the screw or gearing when an obstruction is encountered.

Holding Device for Lathe Permits Quick Changing of Tools

Known as the Wyrick "Toolblock," a tool-holding device for mounting on a lathe compound is now being marketed by Edbert Tools Corp., 2531 N. W. 79th St., Miami 47, Fla. Available in five standard sizes, the device is provided with three tool sockets, one for center type operations and two for radial operations.

Turning, facing, and chamfering operations are performed with one chuck; namely, a straight bit chuck designed for use with standard high speed or carbide-tipped tools. The chuck can be used for either right or left-hand cutting and may also be set for positive or negative rake. For performing cutoff operations, the Toolblock is equipped with a chuck accommodating standard cutoff blades. For all types of center operations, such as center drilling, drilling, boring, tapping, reaming, counterboring, spot-facing, and so on, a quick-change chuck is used which is mounted in the "center" tool socket of the Toolblock, and the various cutting tools are held in collets.



Wyrick "Toolblock"

Aside from the time-saving feature of being able to quickly change from one tool to another, all operations are performed from the compound, thus enabling the operator to power feed all operations. Also available for the Toolblock is an offset bit chuck and knurl chuck.

Accurate Hole Transfer Made Easy With

NIELSEN TRANSFER SCREWS

Simply insert in holes, invert, strike sharply and you have centers and drill circles perfectly located. Reduce time and eliminate spoilage of other methods. 8 sizes, from 1/8" to 3/4" U.S.S. Inexpensive — Last for years.

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The "MIGHTY MIDGET" Line

ORDER DIRECT on our 10 day money back guarantee.

RADIUS DRESSER $34.00
Diamond $7.00

Special Size Angle and Radius Dressers Made to Order. Send for Quotation.

ANGLE DRESSER $39.00
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Hardened shaft—Bearing adjustable for wear. Diamond always perfectly centered. Easily set adjustable 180° stops.

10" Wheel size for DoALL and NORTON Grinders—$39.00. Diamond $7.00.

SPECIAL 14" Wheel Size $89.00

First low cost high precision Angle Dresser on the Market. Can be set very accurately with a Protractor. Works underneath the wheel. Large bearing surfaces.

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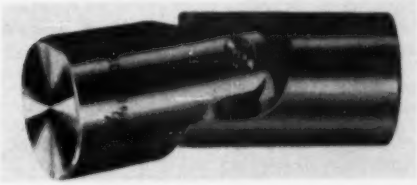
Universal Joint

Available in a full range of standard sizes, solid or bored to fit standard shafting, a universal joint designed for high

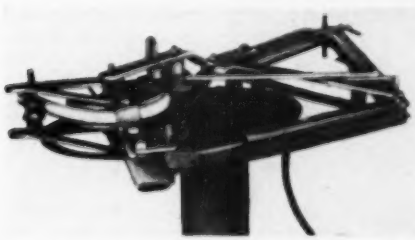


Boston Universal Joint

load carrying capacity and high static torque rating is now being manufactured by Boston Gear Works, 68 Hayward St., Quincy 71, Mass. A self-centering assembly ring is said to assure firm assembly and permit quick and easy disassembly and reassembly. A self-closing ball valve oiler provides for positive lubrication.

Attachment for Iron Bender

A hydraulic attachment consisting of a motor, pump, cylinder, and foot control system for use on its No. 2 universal pipe, bar, and angle iron bender is now being manufactured by the Hossfeld Mfg. Co., Dept. M, Winona, Minn. to provide a smooth, steady bending force for accurate and uniform bending operations. Hydraulic power is generated for the cylinder by the electric pump which is connected to the cylinder by a flexible hose. Actuation is effected with a foot control system, and, as soon as the bend is completed, the cylinder returns the swinging frame to its original set posi-



Hydraulic attachment for Hossfeld No. 2 Universal Pipe, Bar, and Angle Iron Bender

tion. Heavy stock, such as 2 x 2 x $\frac{3}{8}$-inch angle iron and 2-inch pipe, can be bent easily and accurately.

What do you want in a Socket Screw?
• Special Alloy Steel
• Fine Compact Grain
• Accurate Forming
• Uniform Quality
• Great Strength
• Right Temper
• Smooth Finish
• Close Tolerances
they're all in B-RIGHT-ON Socket Screws
Get the facts on Brighton Nu-Process and Uni-Quality! See your nearest mill supply house or write for detailed catalog.
BRIGHTON
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Reading Road at Dorchester Cincinnati 2, O.

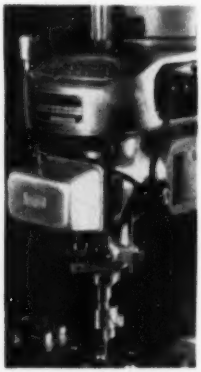
Drafting Scale

Lindly & Co., 80 Herricks Rd., Mineola, Long Island, N. Y., is now marketing the Lindly "Step-Up" Drafting Scale for making enlarged drawings of small parts in ratios of 1:1, 2:1, 3:1, 4:1, 5:1, 8:1, and multiples of 10. Claimed to effect considerable savings in time when designing small parts for machines, electrical and electronic equipment, instruments, and so on, the scale is made of fine boxwood with plastic facings, machine calibrated to high accuracy in decimal parts of an inch. The triangular type scale is double numbered, left to right and right to left.

Boring Unit Provides Steady Feed Rate

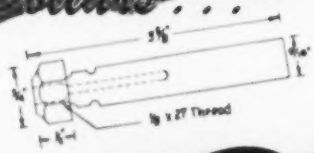
Designed primarily for use on the Bridgeport boring head but adaptable to other boring heads with special brackets, the "Acro-Bore" Boring Unit shown herewith, product of Skyline Tool & Gage Co., 4127 Newark Ave., Cleveland 9, Ohio, consists of a gear-motor drive, fully encased, electrically controlled with an on-off switch, and powered by a 110-volt fractional horsepower motor. For operation, the extension cord of the unit is simply plugged into a convenient electrical outlet; no special wiring is said to be required.

According to the manufacturer, the unit has a steady feed rate of approximately $\frac{7}{8}$ inch per minute on any belt position. The unit feeds down only; to raise the spindle for the succeeding cut, the clutch on the machine is released and the handle raised to the initial cutting position. Designed for easy attachment or removal, the unit measures $2\frac{3}{4}$ x $3\frac{7}{8}$ x $5\frac{1}{2}$ inches and weighs $3\frac{1}{4}$ pounds.



"Acro-Bore" Boring Unit in use

How to trade *Pennies* for *Dollars* . . .



10c more (per gallon) invested in cutting fluids SAVES $50 PER DAY PER MACHINE!

PRICE alone makes no profit. The drawing above illustrates a shackle bolt which is drilled and tapped on a New Britain Automatic. Using an inferior cutting oil 12 taps were used up every 2½ days—12 pieces per tap. A change to Stuart's SPEEDKUT M on a 2½ day run showed 530 pieces per tap—no taps used up. The saving? Taking into full account the pennies—higher price of Stuart *quality* oil: $50 per day per machine!

If you are interested in a saving like this, ask to have a Stuart representative call. There is no obligation — we'll let Stuart performance do the selling.

D. A. Stuart Oil Co.

2741-47 S. Troy Street, Chicago 23, Illinois

Power Tool

Known as the "Handee '85'," a hand power tool for precision work has been announced by Chicago Wheel and Mfg. Co., 1101 W. Monroe St., Dept. MMS, Chicago 7, Ill. Balanced and shaped to fit the hand, the tool has an idling speed of 27,000 r.p.m. and a load speed of 20,000 r.p.m. It weighs 2 lb. and is designed to accommodate interchangeable spring collets of $\frac{1}{16}$, $\frac{1}{32}$, and 1-inch capacity.

Some 200 different accessories are available for use with the Handee 85 in performing grinding, drilling, polishing, sawing, cutting, sanding, engraving, and other operations on metals or other materials. If desired, the tool can be furnished in a steel-gray fitted metal case together with 41 matched attachments.

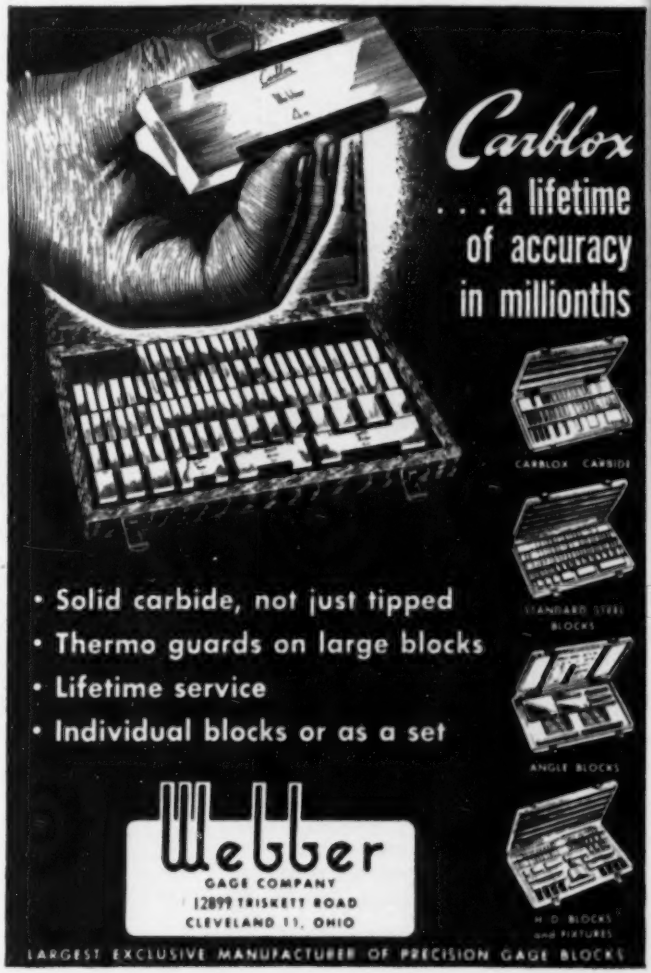
"Handee '85'" Hand Power Tool for precision work

Bench and Drill Press Vise

Known as the "Palmgren" No. 1252, a bench and drill press vise equipped with a swivel bench base and adapter that can be rotated 360 degrees horizontally and locked in any position has been announced by the Chicago Tool & Engineering Co., 8399 S. Chicago Ave., Chicago 17, Ill. The base of the vise can be bolted to a workbench for general shop work, or it can be easily and quickly removed for use of the vise on a drill press or other machine.

"Palmgren" No. 1252 Vise

The vise jaws measure 2½ inches wide x 1 inch deep and can be opened to a maximum of 2½ inches. Removable steel jaw plates are provided, one of which is V-grooved horizontally and vertically for holding round stock or irregularly shaped workpieces.



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For Tool, Die, Pattern or Template layout on metal . . . Quick identification of bar stock, sheet, strips or parts . . . Shows up in sharp relief—dries instantly . . . Write for sample and circular on company letterhead.
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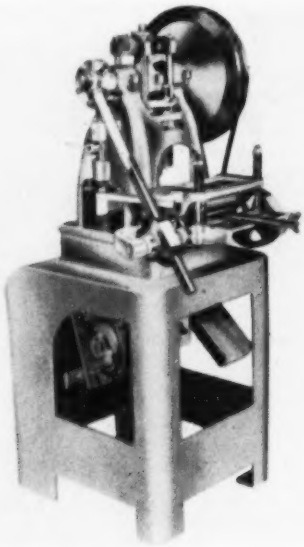
6340 E. Jefferson Ave. • Detroit 7, Mich.

Five-Ton High-Speed Press

The Di Machine Corp., 2714 W. Irving Park Rd., Chicago 18, Ill., has announced the redesign of its Diebel 5-Ton "Hi-Speed" Automatic Press. A sturdy base encloses the motor, belt, and pulley for safer operation. A new feed unit of rigid construction is easily set with spring tension which is evenly distributed for accuracy and long life. The redesigned press utilizes a heavy gear rack which can be easily adjusted. A top roller lifting mechanism and a positive knockout for compound dies are also incorporated in the machine.



Diebel Redesigned 5-Ton "Hi-Speed" Press

Electrode for D. C. Straight Polarity Welding

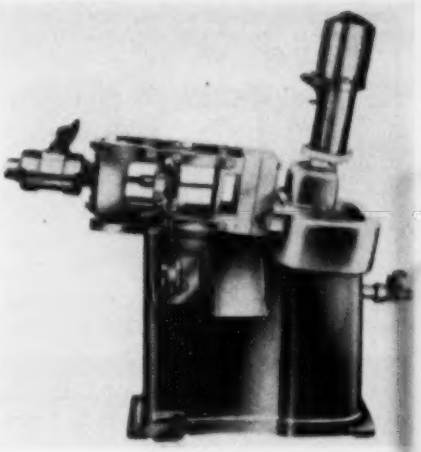
According to Air Reduction, 60 E. 42nd St., New York 17, N. Y., thoriated tungsten, long used in electronic tubes because of its excellent electron emission characteristics, is now available as a non-consumable electrode (Thor-Tung) for Heliwelding—Airco's inert-gas-shielded arc welding process. Particularly useful in d.c. straight polarity welding, the electrode, it is claimed, operates coolly, thus permiting the use of unusually high cur-

rents. In addition, the electrode is said to have excellent arc stability at both high currents and unusually low currents. Moreover, electrode consumption is claimed to be almost negligible and contamination resulting from accidental touching eliminated.

Air-Operated Die Casting Machine

Designated as the Model A16, an air-operator die casting machine with automatic injection of molten metal and automatic opening and closing is now being manufactured by the DCMT Die Casting Machine Corp., Dept. 6, 164 Duane St., New York, N. Y. Designed and built for the casting of small die parts, the machine utilizes fast chill and high cycling speed principles. The machine can handle jobs up to one pound in capacity and utilizes die blocks up to 2½ inches in thickness and as large as 9 x 9 inches. Production speeds are said to average from 600 to 800 shots per hour.

Die blocks supplied with the machine are completely prefrabricated and contain everything necessary except the actual cavities, which can be machined directly into the blocks. Single cavity molds are sufficient because of the high cycling speed of the machine, which features a heavy four-corner toggle lock that is said to absorb shot preasure and ensure relatively flash free castings.



DCMT Model A16A Air-Operated Die Casting Machine

REPLACE OLD COOLANT SYSTEMS, CONVERT "DRY" MACHINE FOR WET CUTTING WITH NEW, HUSKY GRAYMILLS COOLANT SYSTEMS.

They're made for the round the clock operation . . . pumping coolants or heavy oils.

The above model G4-2-04, installed in 5 minutes (on drill press), delivers enough coolant for a 6 to 8 spindle press. It is one of many complete Graymills Coolant Systems which will help you reduce tool costs, increase cutting speeds and improve quality. Recommended as replacements for many smaller coolant systems which are now being used on larger machine tools.

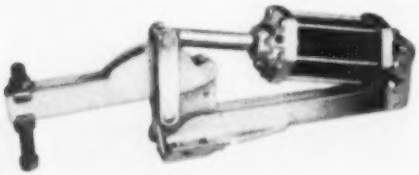
Used on all types of machine tools, the New Improved Graymills Coolant Systems are priced from $49.50. Gear and centrifugal pumps are 1/25 to ⅓ HP. 1 gal. to 70 g.p.m. Tanks 1 gal. to 38 gals. Fittings and recovery pans available.

WRITE TODAY FOR NEW CATALOG AND ENGINEERING DATA. DEPT. 2014

GRAYMILLS CORPORATION Evanston, Ill.

Air-Operated Clamps

Two new models of air-operated clamps identified as the AO-200 and AO-400 have been added to its Knu-Vise line by the Lapeer Mfg. Co., 3056 Davison Rd., Lapeer, Mich. The Model AO-200 has a clamping force of 200 lb. at the end of the toggle bar and the Model AO-400, a clamp force of 1,200 lb. The toggle bar of each model is in the form of a channel which permits the spindle to be moved along its full length to accommodate the work at hand. With the spindle positioned close to the base, the force of each clamp is increased to 475 and to 2675 lb. respectively.



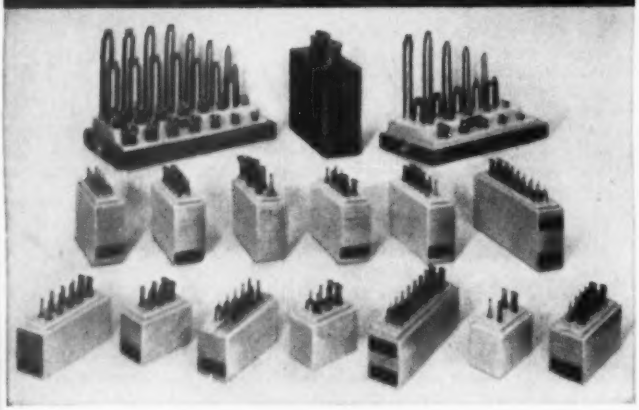
Knu-Vise Air-Operated Clamp

Visual Thread Comparator

The Hanson-Whitney Co., Hartford 2, Conn., has introduced a visual thread comparator designed for the inspection and production gaging of external threads. The comparator has a capacity for checking threads from No. 0 through 3½-inch diameter, coarse or fine pitches in all classes. The upper anvil may be positioned in relation to the lower stationary anvil by inserting a setting plug and tightening a lock screw. The indicator is equipped with tolerance hands and is graduated in tenth of thousandths for checking to within an accuracy of 0.0002 inch. Any type indicator with a ⅜-inch shank can be used with the comparator.

Hanson-Whitney Visual Thread Comparator

You should have one of these
JIG BORING SETS



Having boring tools in sets for jig boring makes for increased efficiency—always handy. Saves your time.

Bokum boring tools are put up in boxes to meet your specific needs—for precision boring of diameters from 1/16" up—economical, efficient, fast.

Send for folder B-1139-6 giving prices and detailed information of all assortments—super high speed steel boring tools.

Ask for B398 carbide tipped tools
B948 solid carbide tools

Bokum continues to serve you after the sale by providing a Resharpening Fixture to keep your tools in factory-new condition. Send for folder BAB-412.

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SINGLE POINT BORING TOOLS - INTERNAL THREADING, BOTTOMING AND FACING TOOLS - CARBIDE TIPPED TOOLS

RECLINABLE
POWER PRESSES

Ideal for general stamping work . . . 4 to 100 tons capacity. Can recline to 40° with perfect safety.

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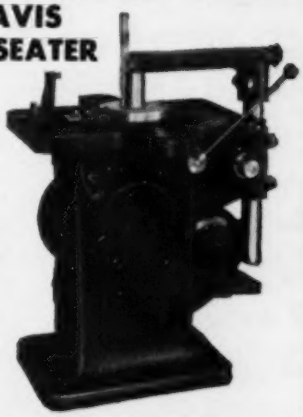
Why Use A Shaper
to cut Keyways when a
DAVIS KEYSEATER
will do the job so much quicker and better?



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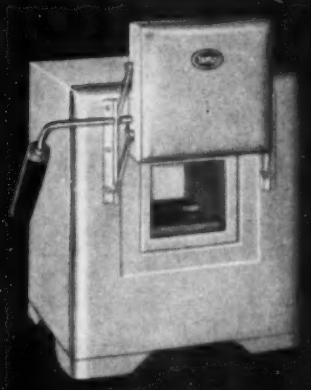
DAVIS KEYSEATER CO.
Exchange and Glasgow Sts.
ROCHESTER, N. Y.



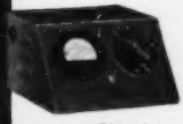
New improved design—welded steel body—4½" dual insulation—uplifting counterbalanced door—heavy duty element embedded in all four sides of heating chamber.

TEMCO

SERIES 1600 ELECTRIC FURNACE

FOR HEAT TREATING TOOLS, DIES, PARTS AND GENERAL LABORATORY WORK.

Fast-heating, sturdy TEMCO model built for continuous use to 1750° F., intermittent to 2000° F. Supplied with either 500 series TEMCOMETER stepless temperature controller and indicator (illustrated) or with Model 292 electronic controlling pyrometer.



Model	Chamber W" H" D"	Volts 50/60 cy.	Furnace and Temcometer	Furnace and 292 Controller
1625	5½x4⅞x9	115	$161.00	$318.00
1620	5½x4⅞x9	230	161.00	318.00
1635	5½x4⅞x13½	115	195.00	350.00
1630	5½x4⅞x13½	230	197.50	350.00

Write for new handy Reference File and dealer's name

THERMO ELECTRIC MANUFACTURING CO.
488 W. Locust St., Dubuque, Iowa

New Shop Literature

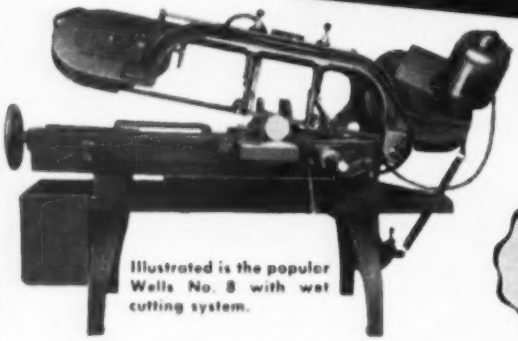
Live Centers. Nielsen, Inc., Lawton, Mich., has available an eight-page Bulletin M containing illustrations and descriptions, together with dimensions and prices, of live centers with Morse and Jarno tapers for heavy duty work; live tailstock spindles; light duty live centers for lathes, grinders, and so on; improved live centers with inserted points and Morse and Jarno tapers for heavy duty work; improved live centers designed for grinders and fitted with deflectors to protect bearing from grinding compound; and live tailstock spindles with bearing mountings.

End Mills. Conical Tool Co., 3802 Buchanan, S. W., Grand Rapids 8, Mich., has prepared a 12-page catalog containing illustrated and descriptive information, as well as complete tabular data, including dimensions and list prices, on ½, 1, 2, 3, 5, 7, and 10-degree tapered end mills; small tip tapered end mills; heavy duty end mills; three-flute heavy duty double end mills; three-flute single end mills; and special extra long end mills. Information on combination fly cutters and boring tools is also presented.

Flexible Shafts. A 12-page bulletin (No. 5008) outlining the basic principles of flexible shaft selection and application has been issued by The S. S. White Dental Mfg. Co., Industrial Div., Dept. 5, 10 E. 40th St., New York 16, N. Y. The bulletin is fully illustrated with drawings, photographs, and tables showing construction details and performance data of both power drive and remote control type flexible shafts. Also included is a description of the variety of sizes and types of flexible casings available for use with S. S. White flexible shafts.

On cut-off jobs... You benefit 4 ways with Wells Saws

1. Fast, continuous cutting action.
2. Greater accuracy on each job.
3. More pieces per length of stock.
4. Greater overall economy.



Illustrated is the popular Wells No. 8 with wet cutting system.

Our 25th Year of Service

HORIZONTAL band sawing is the modern, cost-cutting way to handle cut-off jobs . . . and Wells Saws are the leaders among horizontal metal cutting band saw machines. Simplicity of design means fewer moving parts and easy operation. Ruggedly built to increase productivity and reduce cutting costs, a Wells Saw pays for itself quickly and will give you years and years of dependable, satisfactory service.

Wells

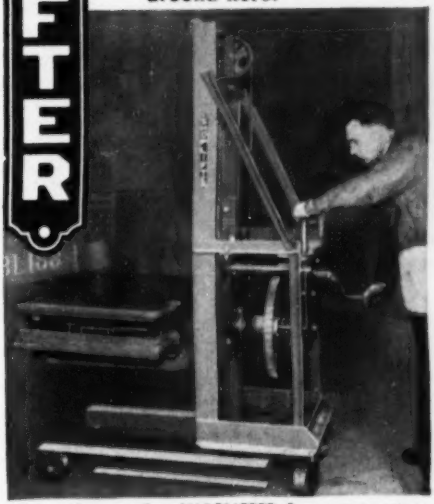
Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
808 TYLER ST. - THREE RIVERS, MICH.

SHOPLIFTER

. . . let an Economy SHOPLIFTER do the heavy work around here.



Every shop needs a SHOPLIFTER. Saves men, saves materials. Besides handling heavy dies, the SHOPLIFTER can stack drums and boxes, unload street trucks, pick up skids and be used as an adjustable height table.

All steel, arc welded frame. Easily operated hoist unit with automatic brake, safely holds load at any height.

500 pound capacity
Type D, hand operated.....$254.00
1000 pound capacity
Type DX, hand operated.....$490.00
2000 pound capacity
Type DX, hand operated.....$590.00
Floor lock to hold machine steady:
$16.00 extra for 500 pound sizes;
$24.00 extra for type DX models.
List prices, F.O.B. Chicago, subject to current discount

ECONOMY ENGINEERING COMPANY
4507 W. LAKE STREET • CHICAGO 24, ILL.

CHICAGO
STEEL PRESS BRAKE
Model No. 131

A new member of the Chicago Press Brake family designed to supplement the larger machines.

Within its rated capacity (11 tons) all operations are handled same as on the larger machines.

All steel construction, enclosed gearing.

Takes up small floor space.

We can make excellent deliveries of this new press.

We make complete line of dies for all Press Brakes.

•

Send for Bulletin 131 for further description

DREIS & KRUMP MFG. CO.
7418 LOOMIS BLVD. • CHICAGO 36 ILLINOIS

"An Easy Guide to Proper Marking," a four-page two-color bulletin (No. LI-M), released by Jas. H. Matthews & Co., 3944 Forbes St., Pittsburgh 13, Pa., illustrates and describes various methods and equipment used in marking products of all types and sizes.

Drill Presses. A four-page two-color illustrated bulletin (No. 402) released by the South Bend Lathe Works, South Bend 22, Ind., describes its 14-inch "Economy Model" drill press. Specifications and a price list, as well as a list of dealers, are included.

Roll Grinders. A 16-page two-color bulletin (No. 118) issued by the Farrel-Birmingham Co., Inc., Ansonia, Conn., describes and illustrates its two-wheel swing-rest roll grinders for grinding and finishing long rolls accurately. Specifications, diagrams, and weight tables are included.

Sub-Zero Industrial Chilling Equipment which is said to provide a temperature range of from 20 deg. F. to minus 120 deg. F. is fully discussed and illustrated in a catalog released by the Sub-Zero Products Division, Deepfreeze Distributing Corp., 3932 Reading Rd., Cincinnati 29, Ohio. Specifications and price information are included.

BE SURE OF SCRATCH-FREE FINISHING!

ELGIN DYMO

DIAMOND COMPOUND

Pure, precision graded diamond particles . . . assure fast, dependable mold polishing—free of possible scratches due to oversize abrasive particles! DYMO comes ready to use—brilliantly color identified in all Bureau of Standards grades—and will not cake or settle. For finer, faster finishing, at lower cost, try Elgin DYMO today! Guaranteed to be in accordance with Bureau of Standards specifications.

Write today for ***Free Demonstration****—right in your own plant!*

INDUSTRIAL PRODUCTS DIVISION
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

Plain and Universal Milling Machines. Complete literature on the Kearney & Trecker Model CK Plain and Universal Milling Machines, available in five sizes, has been prepared by the Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

Mechanics' Hand Tools. A 40-page catalog (No. 49) available from The Cincinnati Tool Co., 1947 Waverly Ave., Cincinnati 12, Ohio, contains illustrated, descriptive, and tabular information on the company's Hargrave line of mechanics' hand tools, including various types of clamps, chisels, punches, drills, wrenches, cutters, file cleaners, rivet busters, and so on. Also covered are chucks for power hammers, clamp parts, and saw vises.

COMET

BORING, FACING, and INTERNAL THREADING TOOLS

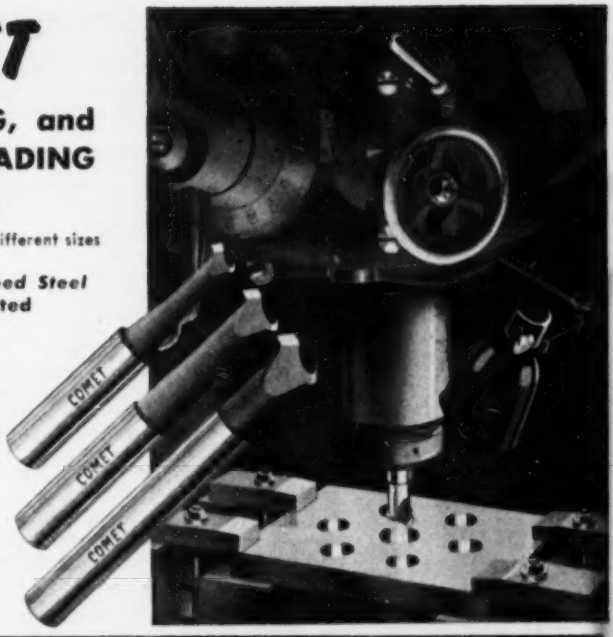
For holes from 1/8" upward, 15 different sizes

Made of Super-High-Speed Steel
Specially Heat Treated

Indispensable for your JIG BORER. The worm-like spiral of the boring heads provides a long useful cutting surface. Their use insures perfect fitting threads. Correctly designed for precision work.

Write for complete data.

Comet Tool Co.
738 Broadway
New York 3, N. Y.



fabricated to your specifications

When designing new machines or redesigning old ones, remember Fabricated Bases are stronger; remember too that Littleford can fabricate shapes from plate and sheet metal to fit any machine, any size. Skilled workmen and modern equipment for shearing, flame cutting, punching, bending, rolling and welding are your assurance of quality work at low cost. No matter what your base problem may be, send blueprints to Littleford for an estimate of cost. Send also for Bulletin on Littleford Fabricated Bases.

MACHINE BASES

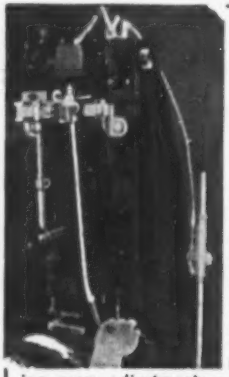
FABRICATORS OF PLATE AND SHEET METALS

LITTLEFORD

LITTLEFORD BROS., INC.
433 E. Pearl St., Cincinnati 2, Ohio

Carbide Grade Recommendation Chart. A chart suitable for wall hanging and outlining the carbide grade recommendations of leading carbide manufacturers for various types of chip removal applications, wear applications and impact applications has been issued by the Wendt-Sonis Co., Hannibal, Missouri.

Hard Metal Drilling Machine. A four-page illustrated folder on the Elox Electron Drill, a hard metal drilling machine with motor-driven automatic feed, has been released by Elox Corp., 748 N. Rochester Rd., Clawson, Michigan.



Protect Your Operators ALL WAYS with *Searjeant* Punch Press SAFETY GUARDS

For sure protection and speedy production, Searjeant Safety Equipment will meet your needs.

Sweep type Guard sweeps across feed area on downward stroke of ram. Once installed nothing need be removed while making press adjustments — complete guard unit swings to one side. Available with or without automatic tally or reset counter. Shield for guard arm at no extra cost, if desired. For complete information, send for Bulletin 125.

Single trip or Non-Repeating Mechanism (fits in clutch operating rod) guards the operator against the hazard of a repeat action of the press caused by his failure to release the clutch operating rod before the completion of the cycle. Send for Bulletin 549.

Fits Any Press • 30 Days' Trial

Searjeant Metal Products, Inc., Dept. B
Box 101, Mendon, N. Y.

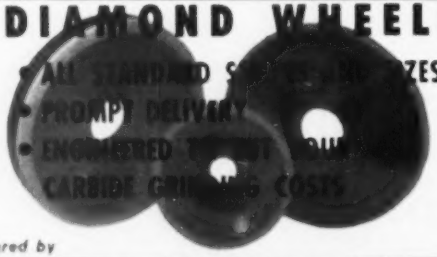
Recessing Tools. Manual DB, issued by The Maxwell Co., 327 Broadway, Bedford, Ohio, describes the use of its Series "DB" recessing tools for use in back-chamfering, back-counterboring, recessing, and internal forming operations on automatic machines. Photographs, diagrams, sketches, and cutaway illustrations indicate construction features and operating principles of the tools.

"Machines Throw Men Out of Work," is the title of an eight-page booklet released by the Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich., which presents a year by year (1910 to 1950) study of the effect on employment of production workers by the installation of so-called "labor-saving" equipment in U. S. industry. All figures contained in the booklet were compiled by Denham & Company, Detroit, from figures in the files of the U. S. Department of Commerce and the U. S. Department of Labor.

Attachments and Accessory Equipment for Surface Grinders are fully presented in a 16-page two-color illustrated catalog (No. 310), released by The Taft-Peirce Mfg. Co., Woonsocket, R. I. Information on vernier fine-feed attachments, riser blocks, wet grinding attachments, index grinding fixtures, spindles, adapters, wheel dressers, sine bar sets, and so on, are included.

Motor-Driven Arc Welder. A four-page two-color bulletin (No. 1302 10M) published by The Lincoln Electric Co., Dept. 253, Cleveland 1, Ohio, fully describes the "Shield Arc" S.A.E. motor-driven arc welder which is said to provide an exceptional range in currents for all types of welding operations from thin metal to heavy plates and structures. Complete dimensions and specifications are included.

DIAMOND WHEELS



Write for catalog and name of distributor nearest you

Manufactured by

UNITED STATES DIAMOND WHEEL CO. AURORA ILLINOIS

IMMEDIATE DELIVERY

Extra Long Length

High Speed DRILLS

Straight Shank
No. 1 - 60

No. By Gage	Length Inches	Our Price Net Each
1 to 10	6 1/4	$1.00
11 to 20	5 3/4	.90
21 to 30	5 3/8	.80
31 to 40	5 1/4	.70
41 to 50	4 1/2	.60
51 to 60	4 1/4	.50

Straight Shank

Size Inches	Length Overall Inches	Length Flute Inches	Price Each Net
1/8	12	9	$1.65
9/64	12	9	1.65
5/32	12	9	1.65
11/64	12	9	1.65
3/16	12	9	1.65
13/64	12	9	1.76
7/32	12	9	1.76
15/64	12	9	1.95
1/4	12	9	1.95
17/64	12	9	2.05
9/32	12	9	2.05
19/64	12	9	2.20
5/16	12	9	2.20
21/64	12	9	2.50
11/32	12	9	2.50
23/64	12	9	2.75
3/8	12	9	2.75
25/64	12	9	3.05
13/32	12	9	$3.05
27/64	12	9	3.30
7/16	12	9	3.30
29/64	12	9	3.60
15/32	12	9	3.60
31/64	12	9	3.60
1/2	12	9	3.60

Taper Shank

17/32	15	12	$7.00
9/16	15	12	7.70
19/32	15	12	8.25
5/8	15	12	8.80
21/32	15	12	9.00
11/16	15	12	9.10
23/32	15	12	9.35
3/4	15	12	9.50
25/32	15	12	10.50
13/16	15	12	12.00
27/32	15	12	12.65
7/8	15	12	13.20
29/32	15	12	13.75
15/16	15	12	14.30
31/32	15	12	15.40
1	20	15	17.60
1-1/16	20	15	18.70
1-1/8	20	15	19.80
1-3/16	20	15	22.00
1-1/4	20	15	24.00

VICTOR MACHINERY EXCHANGE, Inc.

251 Centre St. Phone: CAnal 6-5575 New York 13, N. Y.

Hydraulic Control Valves. Twenty-two page Catalog 200 Section 4 released by the Logansport Machine Co., Inc., 801 Center Ave., Logansport, Ind., fully describes and illustrates its line of balanced-pressure piston-type hydraulic control valves for use in a wide variety of applications. Specifications and dimensional diagrams for each type valve are included.

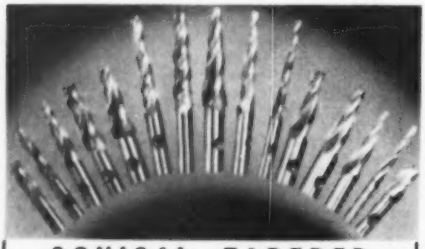
Wrenches Chucks and Vises available in both 2 and 3-jaw models for use on turret and engine lathes, as well as on semi-automatic, pipe threading, and cutting-off machines, are described and illustrated in a six-page two-color bulletin (No. 201-A) issued by the Thomas Hoist Co., 28 S. Hoyne Ave., Chicago 12, Ill. Specifications and dimensional diagrams are included.

Mist Type Coolant System for use in grinding carbides on the Cincinnati No. 2 Cutter and Tool Grinder is fully illustrated and described in Circular No. M-1716 now available from the Cincinnati Milling Machine Co., Cincinnati 9, Ohio. Recent improvements made in the system are explained.

"Work Done On the Blanchard." The Blanchard Machine Co., 64 State St., Cambridge 39, Mass., has published a fourth edition of its booklet, "Work Done On the Blanchard," which contains 83 pages of information on the surface grinding of various types of metal, glass, and ceramic parts. The booklet is profusely illustrated with halftone line drawings showing correct grinding techniques, chucking methods, holding fixtures, and other equipment.

Safety Eye Shields. A four-page two-color folder released by Stanley Electric Tools, 520 Myrtle St., New Britain, Conn., fully describes and illustrates the "Flud-Lite" safety eye shield for use on 10-inch and larger grinders to provide for maximum visibility and eye protection. Specifications and prices of various models are included.

Emery Cords and Tapes. The E. C. Mitchell Co., Middleton 8, Mass., now has available a descriptive folder containing actual samples of a variety of emery cords and tapes for use in polishing and burring small holes, slots, dies, and other products.



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For Faster, Smoother Cutting — Less Breakage.

Reduced Spindle Vibration.

Long, Durable Performance.

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CONICAL TOOL CO.

3802 Buchanan S.W., Grand Rapids 8, Mich.

Easily Operated, Dependable

HAND BENCH SHEAR

You get fast slitting of long sheets, cutting of steel bars and 1/8" angle iron with this handy bench shear. Profitably used throughout industry for years. Capacity 3/16 x 2" bars; 10 gauge sheets.

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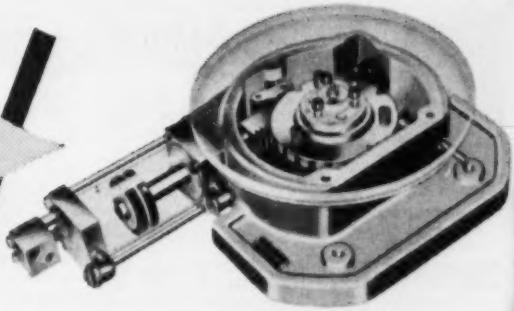
W. A. WHITNEY MFG. CO.

640 RACE ST. ROCKFORD, ILL.

better than ever!



ALLEN
AIR OPERATED
dial feed tables

MODEL 11EA and 11EB

- Working Mechanism Completely Enclosed
- Rack and Gear Drive
- Adjustable from 4 to 24 Index
- Guaranteed Against "Override"
- All Working Parts Flame Hardened

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STOP DUSTS *with* DUSTKOP

22 different Dustkops — 300 cfm to 10,000 cfm

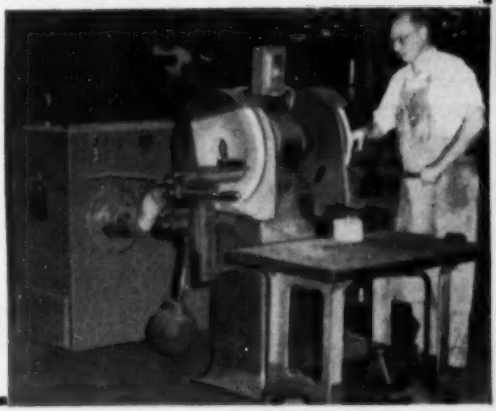
available from stock.

. . . . dusts from,

- **Surface Grinders**
- **Tool Grinders**
- **Cutter Grinders**
- **Abrasive Belts, Discs**
- **Polishing, Buffing . . .**

. . . any industrial dusts.

Send now for new Catalog 605b. Describe dust problem for recommendation by return mail; no obligation.



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SOMERSET Radius Dresser SAVES TIME

Thousands of Somerset Dressers in service. Offer outstanding features — Wheel is dressed from below, avoids removal of guard. Stop pins permit rotation thru 180° or 90° either direction. Wearever bearing is dustproof.

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SOLD THRU LEADING SUPPLY HOUSES

GROBET CHATTERLESS COUNTERSINKS

Six staggered cutting edges give shearing cut that eliminates all chatter.

Send for catalog BC1.

GROBET FILE CO. of AMERICA, INC.
421 Canal Street N. Y. 13, N. Y.

Curved-Tooth Milling Cutters. An eight-page two-color catalog issued by the Aber Engineering Works, Inc., Waterford, Wis., fully describes a line of curved-tooth milling cutters available in high speed steel, cast alloy tipped, and carbide tipped types. Complete specifications, including price lists, are included.

Tube Rolling Control. The Crane Packing Co., 1800 Cuyler Ave., Chicago 13, Ill., has released an eight-page two-color catalog which describes and illustrates the "John Crane" Tube Rolling Control designed to provide an effective means for accomplishing uniform holding of expanded tube joints and for avoiding over-rolling and over-working of ferrous and non-ferrous tube metals. Complete specifications are included.

Layout Drilling Machine. A four-page two-color catalog (LDM) issued by Bryant Machinery & Engr. Co., 400 W. Madison St., Chicago 6, Ill., presents a complete explanation of the work handled by the Cleereman Layout Drilling Machine and details of its construction and operation. The catalog also lists complete specifications and extra equipment available for the machine.

KENNAMETAL CUTTING TOOLS *for Increased Productivity*

KENNAMETAL *Inc* LATROBE, PA.
CEMENTED CARBIDE TOOLS, BLANKS, MILLING CUTTERS

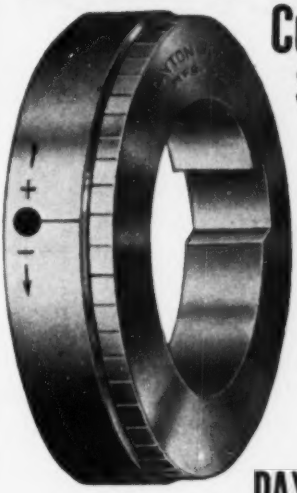
OFFSET BORING HEADS in 9 Sizes

These CRALEY Boring Heads minimize overhang and have easily read calibrations. The boring bars go to the bottom of the dove-tail bearing to make short set-up. Tension screws are on opposite sides and ends of block to throw all cutting strain against solid metal.

Write for illustrated Catalog MS.

C. C. CRALEY MFG. CO.
SHILLINGTON PENNSYLVANIA

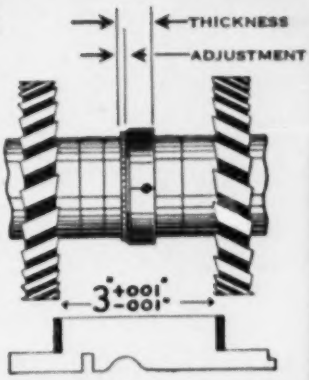
ACCURATE SPACING of Milling Machine Gang Cutters with Micrometer Adjustable Spacing Collars



Designed for accurate spacing of side milling cutters, gang milling and other multiple milling setups.

Collar may be adjusted by thousandths by merely loosening cutter arbor nut. Also quarter - thousandths adjustments.

WRITE FOR DETAILS



DAYTON ROGERS MFG. CO., MINNEAPOLIS, MINNESOTA

LET ENCO'S VERSATILITY CUT YOUR COSTS

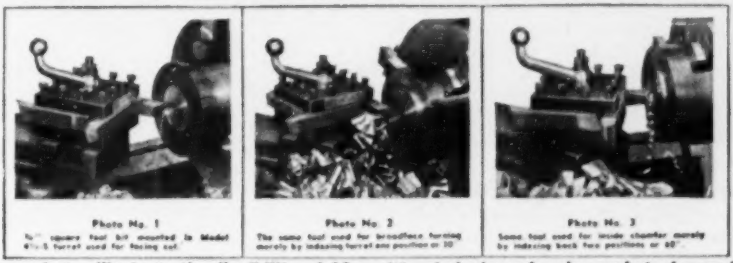


Photo No. 1
¾" square tool bit mounted in Model 4½-S turret used for facing cut.

Photo No. 2
The same tool used for broadface turning merely by indexing turret one position or 30°.

Photo No. 3
Same tool used for inside chamfer merely by indexing back two positions or 60°.

The above photos illustrate the flexibility of 12 position indexing whereby each tool may be used in three different working positions.

SPECIFICATIONS OF A FEW OF MANY ENCO TURRETS

Model No.	HD-2	6-S	4½-R	4½-S	3½-R	3½-S
Suggested Lathe Size	16" to 24"	14" to 20"	15" to 19"	13" to 16"	12" to 15"	10" to 13"
Tool Block Size	6½" sq.	6" sq.	4½" sq.	4½" sq.	3½" sq.	3½" sq.
Solid Tool Capacity	1½"	1¼"	1"	¾"	⅞"	½"
Price	**$152.50**	**115.00**	**73.50**	**59.00**	**49.50**	**39.50**

WRITE FOR CATALOGUE NO. 50 WHICH SHOWS TYPICAL APPLICATION PHOTOS OF MANY OF ENCO'S 35 MODELS ON ACTUAL JOBS.

Also Mfrs. of Milti-Mite Magnetic Base Units and Enco Hexturret Bed Turrets and Tailstock Turrets for 9" to 18" Lathes

ENCO MANUFACTURING CO., Dept. 2010, 4524 Fullerton Ave., Chicago 39, Ill.

DESMOND PRECISION BALL BEARING DRESSER REPLACES DIAMONDS

Wheel dressing costs have been cut in half by using new Desmond ball bearing type mechanical dressers *in place of diamonds*. These precision dressers have produced exceptional surface smoothness in several applications where diamonds were thought essential. For example:

The dresser application pictured above, at Robbins & Myers, Inc., Springfield, Ohio, brought this comment from Department Foreman Worley:

> "The new Desmond dresser does the job as fast as the single point diamond nibs we used previously. It costs half as much and is a lot more rugged. We don't have to worry about accidental damage or loss of the diamond."

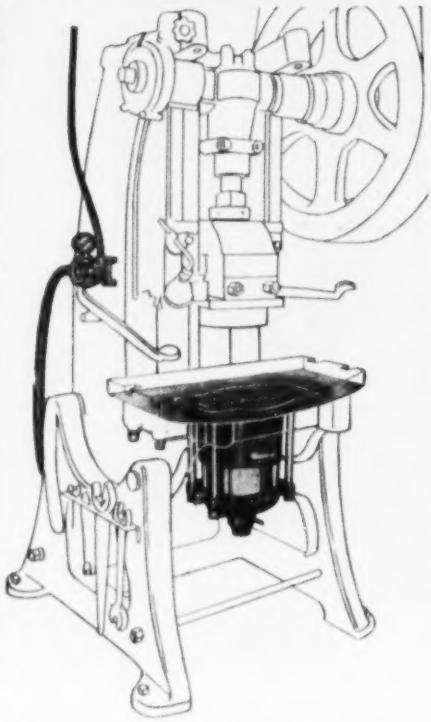
Buy these and other Desmond dressing tools from your industrial distributor. The Desmond-Stephan Manufacturing Co., Urbana, Ohio.

Desmond
the only complete line of
DRESSERS & CUTTERS

DIE CUSHIONS

for all

PUNCH PRESS REQUIREMENTS



Adaptable to all deep drawing operations and all pressure pad control on forming dies.

Write for catalog No. 100

DAYTON ROGERS
Manufacturing Company

Minneapolis 7, Minnesota

"THE PAGE COUNTER"

Because MODERN MACHINE SHOP contains nearly 400 pages of editorial features and blue ribbon advertisers, this guy is afraid his advertising won't be read. Says he'd rather be in a thin book for better display. Using the same logic, he would set up a retail store in the desert rather than in the main shopping district because there is less competition.

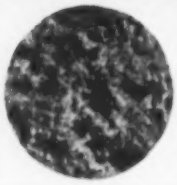
WHAT HE DOESN'T UNDERSTAND IS

that MODERN MACHINE SHOP is a veritable market place for metal working equipment. Buyers shop where the most merchandise is for sale. Each issue of MODERN MACHINE SHOP exhibits the greatest variety of machines and tools available to buyers for their selection. It's an action-producing, digest size book that pulls inquiries which turn into sales. Results tell the story. Gardner Publications, Inc., Cincinnati 2, Ohio.

SERVICES DIRECTORY

GRINDING • STAMPINGS • TOOL and DIE WORK
MACHINE WORK • CASTINGS • HEAT-TREATING
FORGINGS • EMPLOYMENT • BUSINESS • ETC.

Which is better for YOUR product?

NON-GRAN SAND CASTING	NON-GRAN CENTRIFUGAL
	

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American Non-Gran Bronze Co., Berwyn, Pennsylvania

PRECISION MACHINE WORK
NON-GRAN
CASTINGS • SAND & CENTRIFUGAL

CENTERLESS GRINDING — Straight cylindrical, shoulder, profile and multiple diameters, any material analysis; also non-ferrous materials. Accurately ground taper pins and straight dowel pins. Brown & Sharpe and Swiss Automatic screw machine parts, heat treated and ground if necessary. Light bench type production drilling. Expanded facilities insure prompt and accurate service. Send blue prints or samples for estimates. The Porter Machine Co., 3139 Enyart Ave., Cincinnati 9, Ohio.

Dovetail, Flat and Circular Form Tools, Reamers, Counterbores

Prompt, Efficient Service. Attractive Prices

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ALL SIZE BLANKS IN STOCK.
Teeth Cut To Your Specifications.
Prompt Delivery. *Write for quotation.*

Greaves Machine Tool Co.

division of J. A. Fay & Egan Co.

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FOR SALE

New 22" and 16" HERCULES High Speed Precision Shapers arranged M/D with Universal Swivel Vise.

Quotation Upon Request.

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PATTERNS

Wood and Metal — also Match Plates.
For all kinds of castings—large or small.
Estimates on Request.

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2231 Buck St., North of Harrison Ave.
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Eastern Centerless Way

Our new plant with increased facilities assures

PROMPT SERVICE

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PRODUCT FOR SALE

Small utility gasoline engines and transmission patents, design production tools and know-how. Product proven in field. Box No. 11, c/o Modern Machine Shop, 431 Main St., Cincinnati 2, Ohio.

ADVERTISING RATES
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SENT UPON REQUEST
Write Modern Machine Shop
431 MAIN ST., CINCINNATI 2, OHIO

Three-Step Metallizing Process which is said to provide an unsually hard, oil holding surface by using "Sprabond" wire is fully described and illustrated in a four-page two-color bulletin (No. 57B 30M) released by the Metallizing Engineering Co., Inc., 38-17 30th St., Long Island City 1, N. Y. Information on various types of applications is included.

Solid Tungsten Carbide Tools. A 12-page two-color folder issued by The Charles L. Jarvis Co., Middletown, Conn., describes and illustrates a new line of precision machine ground solid tungsten carbide rotary files, reamers, end mills, internal grinding tools, boring bits, and knurls.

Jaw Clamps. A four-page two-color folder now available from J. & S. Tool Co., Inc., 475 Main St., East Orange, N. J., illustrates and describes four sizes of jaw clamps which can be used to fasten various shapes and sizes of workpieces to lathes, planers, milling machines, drill presses, and other machine tools. A chart of T-nut sizes is included.

Precision Production and Toolroom Machines. Hardinge Brothers, Inc., Elmira, N. Y., now has available two pocket-size booklets, one of which illustrates and describes precision production machines, including chucking machines, second-operation machines, and hand screw machines. The other booklet describes and illustrates precision toolroom machines, including lathes and milling machines.

Adjustable Boring and Threading Bar Holders, available in two sizes with holding capacities from $\frac{1}{16}$ to $\frac{1}{2}$ inch and $\frac{1}{16}$ to $\frac{5}{8}$ inch, are described in a four-page illustrated folder prepared by Reisinger Mfg. Co., 333 Thomas Ave., Rochester 17, New York.

Machine Tool Attachments for milling, boring, slotting, internal grinding, drilling, indexing, keyseating, and other operations are described and illustrated in a 20-page catalog (No. 450) published by Master Mfg. Co., 1300 East Ave. A, Hutchinson, Kansas. Covered in detail is the Master Lathe Converter which is said to adapt any engine lathe for most types of machining operations, both external and internal.

Anti - Scoring Concentrated - Stablized Lubricants for lubricating centers, cams, bearings, gages, screws, nuts, machine ways, die set posts, and so on, as well as for cutting, grinding, lapping, broaching, drawing, stamping, and other operations, are described in a four-page illustrated folder issued by Chicago Mfg. & Distributing Co., Dept. 11-M, 1928 W. 46th St., Chicago 9, Ill. Also described and illustrated in the folder are helical-groove centers.

Brake Dies. A four-page two-color bulletin published by Service Machine Co., Inc., 158 Miller St., Elizabeth 4, N. J., illustrates and describes various types of brake dies, including the manner in which they are produced.

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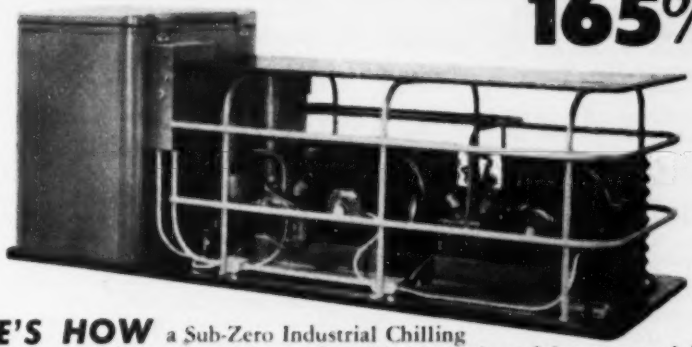

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When a prominent mid-west manufacturer subjected his purchased tools to —120° F. in a Sub-zero Chilling Unit, an average of 165% increase in the tool life was experienced. The procedure used is as follows:

Operation	Tool	Tool Life Before Cold Treatment*	Tool Life After Cold Treatment	Increase
Milling foot pads on chrome moly steel motor mount	4½" end mill	40	84	110%
Drilling 338 holes in aluminum airplane fin	No. 29 drill	112	280	150%
	No. 21 drill	54	108	100%
	⅛" drill	82	164	100%
	No. 41 drill	144	288	100%
Drilling 16 holes in chrome moly steel motor mount	No. 45 drill	8	50	525%
Drilling 12 holes in chrome moly steel side plates of motor mount	Combination 2⅞" drill and ⅜" reamer	60	140	133%
Drilling 2 stainless steel parts	F drill	200	300	50%
Drilling holes in buck board for gun turret	No. 30 drill	10	32	220%
Average Increase in Tool Life on 6 Typical Jobs In This Plant				165%

* (Number of pieces machined per grind)

1—Heat tool to 212° F. in boiling water.

2—Allow tool to return to room temperature.

3—Chill for four hours at — 120 in a Sub-Zero Chilling Unit.

4—Allow tool to return to room temperature.

5—Repeat cycle six times.

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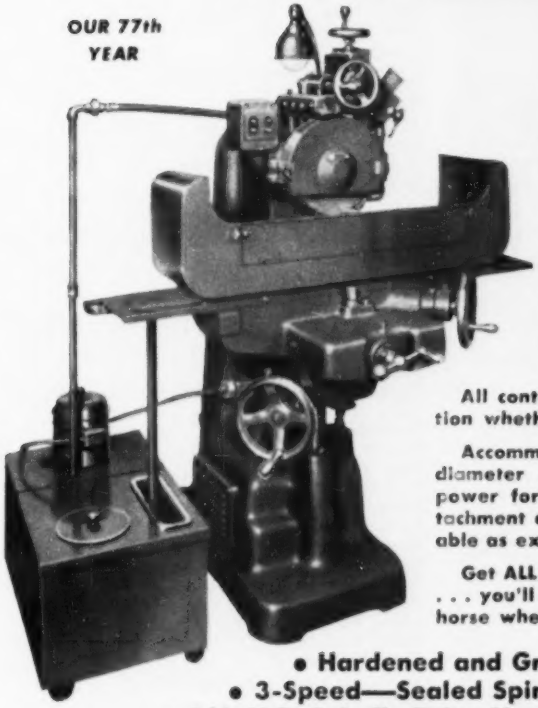

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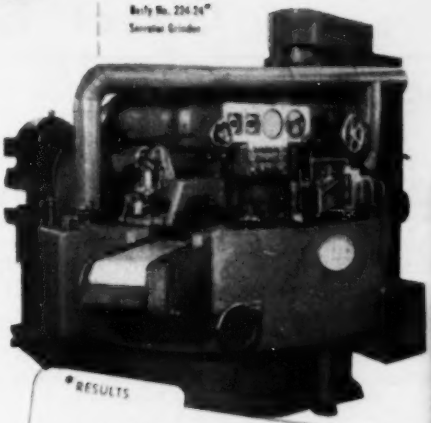

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Guest Editorial

Hope for the Future

By George S. Benson
President, Harding College

PEOPLE of good will have hoped and prayed since the dawn of civilization for "peace and plenty" on the earth. Philosophers have propounded ten thousand learned theories on how it could be achieved. But only one recipe for lasting peace has appeared. The Man of Galilee gave it to the world. Man has failed to make it work. Peace on earth thus remains a spiritual goal. It perhaps is THE goal, mankind's ultimate quest, the Why and Wherefore of life; for it cannot be attained until Christianity is lived in all nations, becomes a flame in all men's hearts.

On the other hand, "plenty" is a relative term in popular understanding. The word makes me recall the picture in my old school reader showing "The First Thanksgiving" as it was observed by the American pilgrims. The "plenty" in that picture was food—turkey, and pumpkin pie, and potatoes baked under the coals. The Pilgrims were thankful for their prospects in the new world, for their freedom, and for their "plenty" or sufficiency of food.

Unquestionably the Pilgrims would have been only a little less thankful had their harvest of foodstuff been considerably less bountiful. Yet "bread"—meaning, in its broadest sense, a sufficiency of food, or "plenty"—has become the great political and social watchword in our strife-torn world. Some people have made "bread" a god. The Communist leaders are marshalling great masses of humanity to make war over it—a war they describe as the "Have Nots" against the "Haves."

In sections of Europe, in Asia and especially in the Orient, I have seen countless millions of poverty-stricken people whose every waking moment had to be concerned with seeking food for survival. Their agriculture had progressed little in the last thousand years. It is upon these people, uninformed and constantly at grips with hunger, that the Kremlin masters are waging their propaganda wars. Had these masses achieved any substantial degree of "plenty" it is doubtful that the Reds would have succeeded so well in this effort.

Thus "plenty" is a practical stepstone toward peace on earth as well as a humane ideal. We in America have found a recipe for "plenty"—our freedom philosophy in government and our free enterprise economic system. It hasn't made everybody rich but the poorest American citizen is twice as well fed as ninety-nine per cent of Asia's millions—and we are a nation of peace-lovers. The degree and the wide distribution of America's "plenty" caused the Communist plotters long ago to give up the idea of violent revolution here. So "plenty" *is* a factor in war or peace.

Until world-girdling, war-making Communism is overcome, we need as a nation to concentrate our thinking, and planning, and action on that objective. But if we are victorious there is a great challenging task awaiting—the expansion of "plenty" to the underdeveloped and unwisely used regions of the earth. We cannot do it by sending federal government funds and a handful of technicians to Borneo and Mandalay; or a steel plant or electric generator to Yugoslavia, or a combine to China.

The two great hopes for future peace and plenty on earth are education and research. Once the world menace of international Communism is overcome, we could take a fraction of the amount of money spent in Europe on the Marshall Plan and bring a million college-age youth to America to learn, first hand, what makes America tick. Those with aptitudes could be kept here for extended training in the ways American people get things done—in agriculture in industry, in forestry and mineral development.

Think of what 100,000 Chinese with American agricultural and industrial know-how, and with a first hand knowledge of our distribution and marketing system, could do in a generation in a free enterprise China! In 25 or 30 years such a force could bring that wallowing backward country upon the road of progress and plenty. The same thing could transpire in every other nation. And during that 30 years, American science, through research would be further exploring and developing the limitless possibilities of God's material blessings to the people of the earth—the natural resources.

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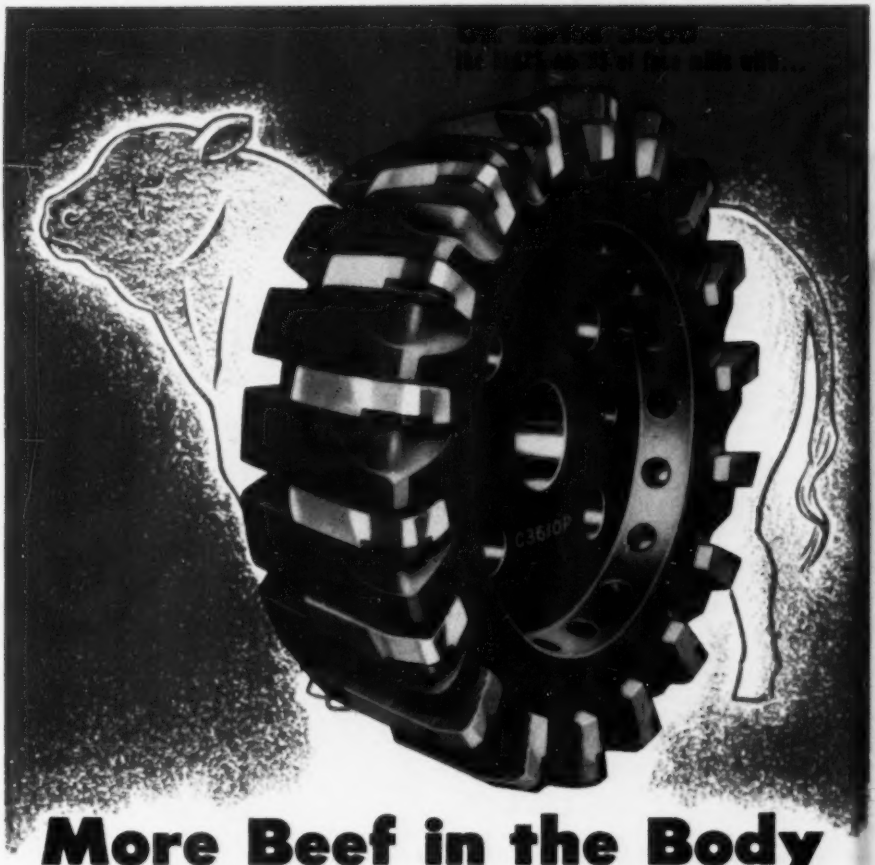

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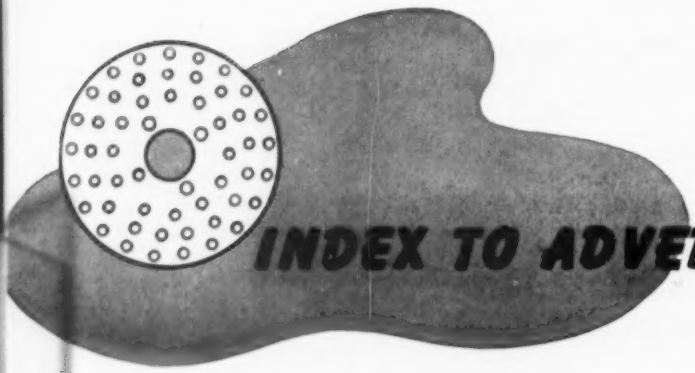

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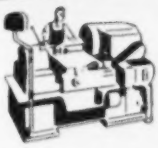

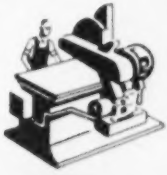

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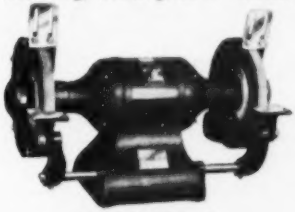

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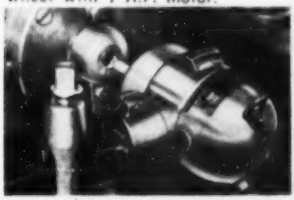

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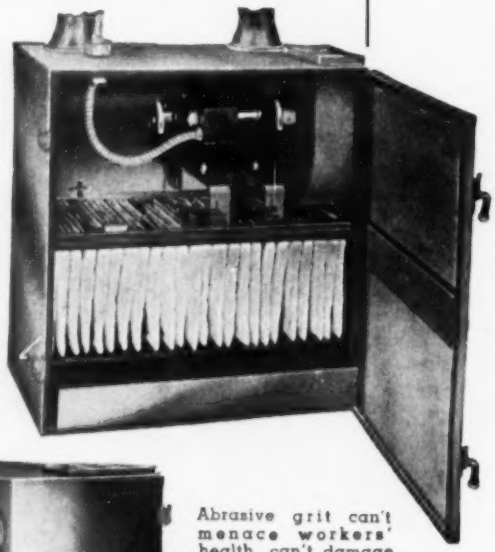

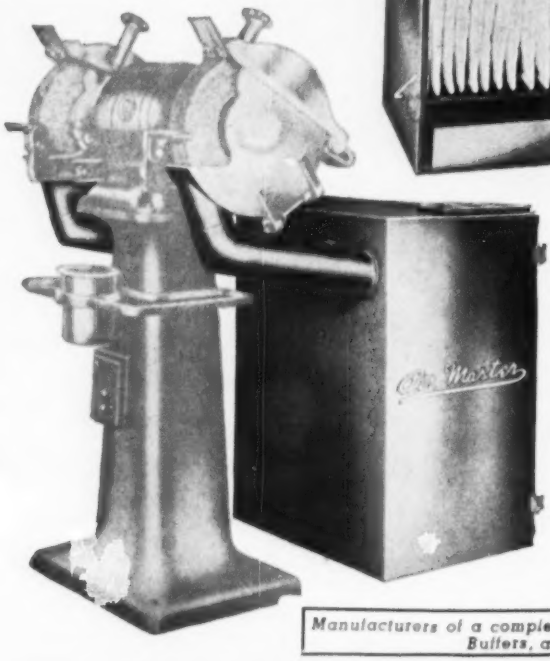

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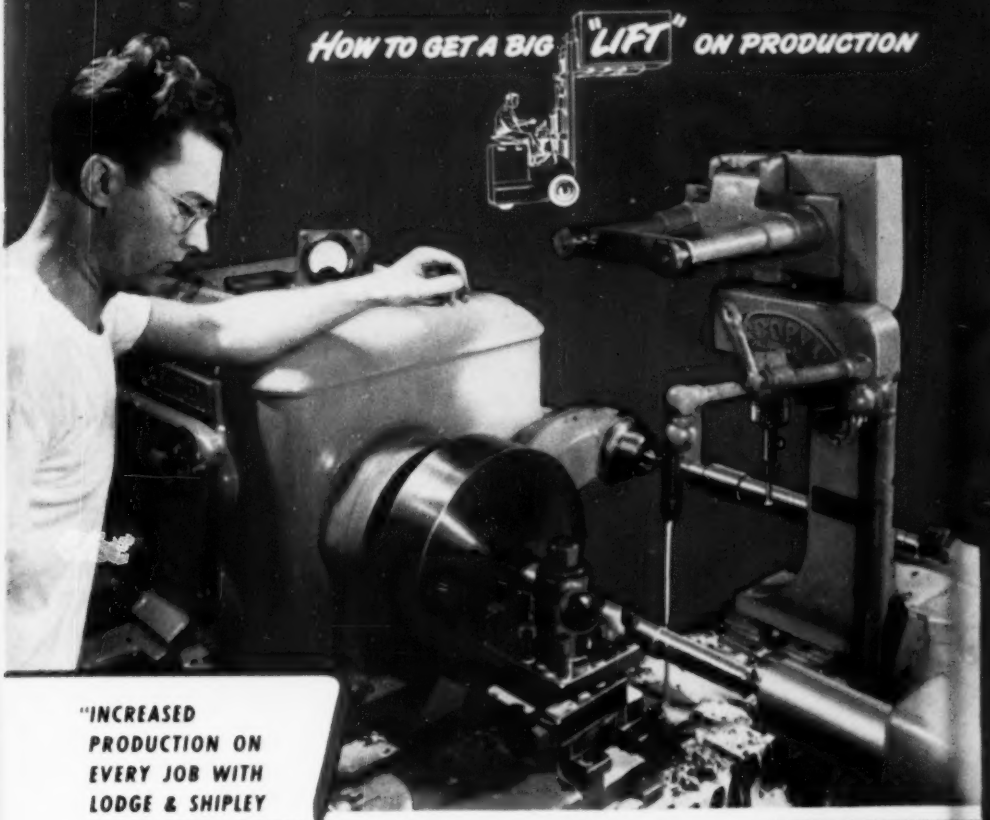

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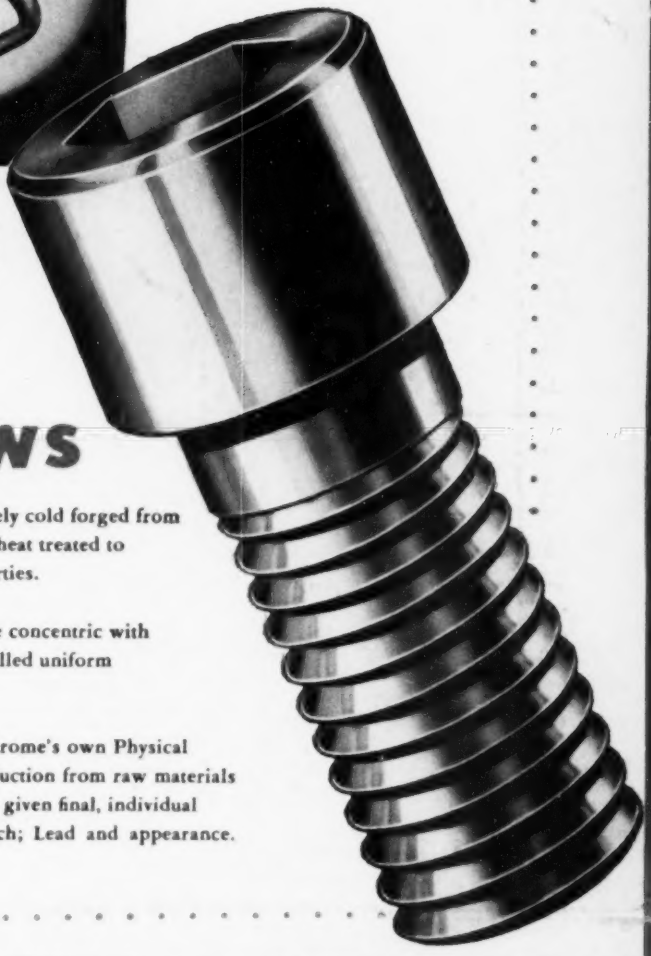

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